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AVIATION WEEK

A McGRAW-HILL PUBLICATION

IAS Meeting: Reports on Missiles, Propulsion, Materials

Lockheed F-104As

American's Boeing 707 and United's Douglas DC-8. Scheduled to start service in 1959, these turbojet airliners, with speeds close to 600 miles per hour, will cut coast-to-coast travel time to less than five hours.

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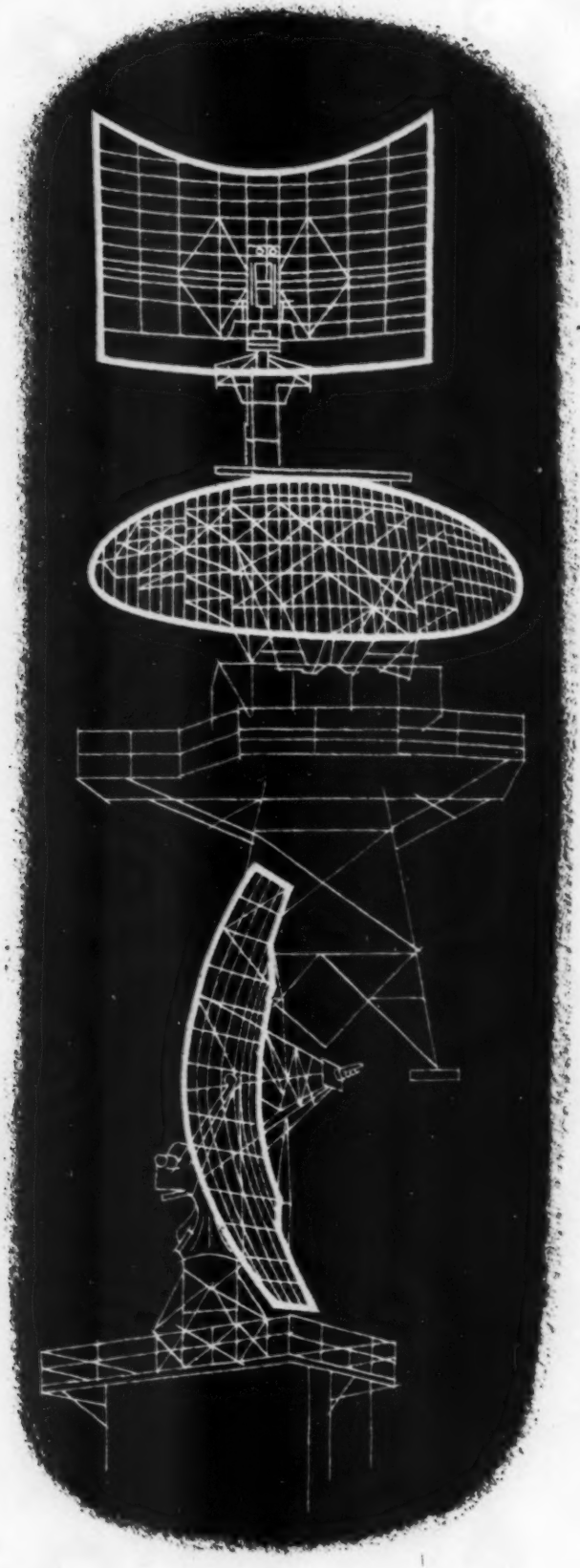

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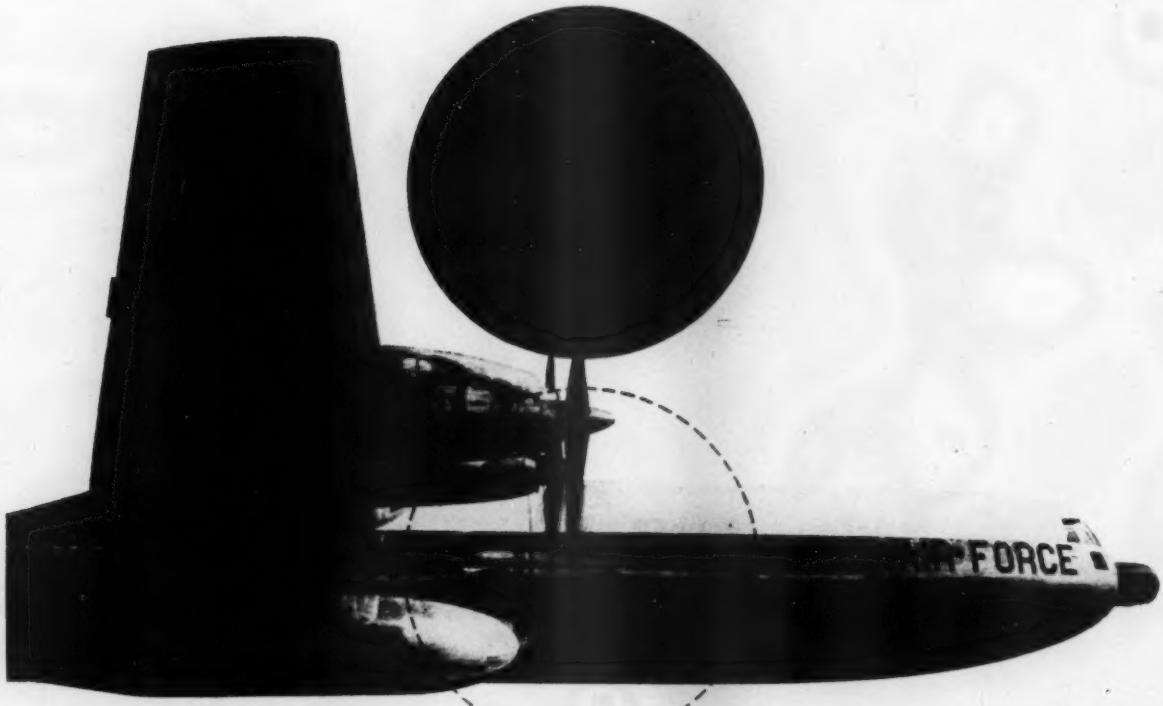

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AVIATION CALENDAR

Feb. 5—Minimum Charges Group, International Air Transport Assn., New York, N. Y.

Feb. 7—Annual Mid-Winter Symposium of the New York Section, Instrument Society of America, Garden City Hotel, Long Island, N. Y.

Feb. 7-8—Jet Know-How Symposium for members of National Business Aircraft Assn., sponsored by USAF (by invitation), Wright-Patterson AFB, Ohio. For details write: William K. Lawton, executive secretary, NBAA, 344 Pennsylvania Bldg., Washington 4, D. C.

Feb. 12—Atlantic Commodity Rates Board, International Air Transport Assn., New York, N. Y.

Feb. 14-15—1957 Transistor and Solid State Circuits Conference, University of Pennsylvania, Philadelphia, Pa.

Feb. 14-15—National Jet Age Conference, sponsored by the Air Force Assn., Sheraton Park Hotel, Washington, D. C.

Feb. 16-19—6th Annual Trade Show & Convention, Institute of Surplus Dealers, New York Trade Show Bldg., New York.

Feb. 18—Helicopter Fares and Rates Working Group, International Air Transport Assn., New York, N. Y.

Feb. 24-26—Sixth Annual Texas Agricultural Aviation Conference & Short Course on Pest Control, including aircraft and equipment displays, Memorial Student Center, Agricultural & Mechanical College of Texas, College Station. Fly-in participants may use Easterwood Field.

Feb. 25-26—Mid-Season Meeting, Canadian Aeronautical Institute, Ft. Garry Hotel, Winnipeg.

Feb. 26-28—Western Joint Computer Conference, sponsored by IRE, AIEE and ACM, Hotel Statler, Los Angeles, Calif.

Mar. 5-7—Fifth Annual Air Safety Forum, Air Line Pilots Assn., Hotel Shoreland, Chicago, Ill.

Mar. 7-9—National Conference on Aviation Education, Hotel Mayflower, Washington, D. C.

Mar. 11-15—1957 Atomic Exposition, including Nuclear Engineering & Science

(Continued on page 6)

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Vol. 66, No. 5

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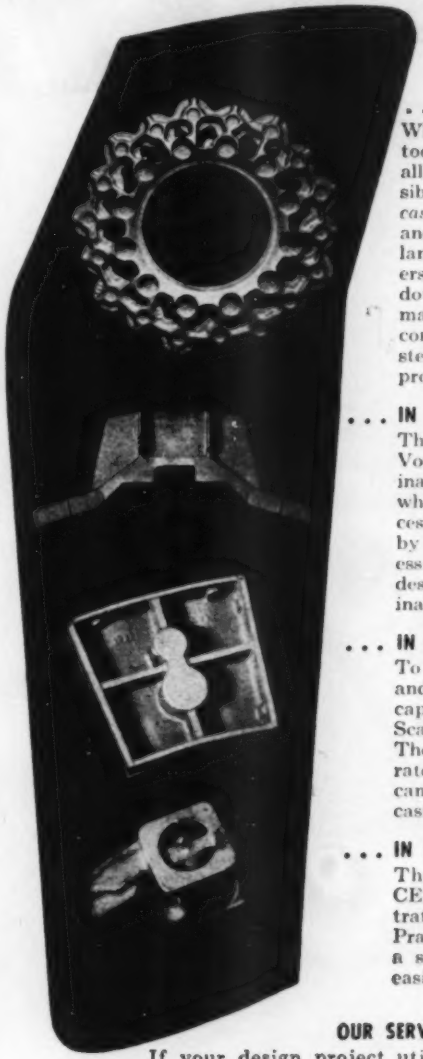
CERAMICAST* HAS CHANGED DESIGN CONCEPTS . . .



. . . IN AIRCRAFT BRAKE SYSTEMS

When aircraft landing speeds became too fast for braking systems of light alloys, CERAMICAST made it possible to produce backing plates in *cast steel* that will stand the stresses and high temperatures placed on the landing gear of today's super bombers and fighters when they "touch down." Backing plate designs of six major U.S. aircraft have now been converted from light alloys to the cast steel of Lebanon's CERAMICAST process.

. . . IN JET ENGINE COMPONENTS

This jet removal track for the Chance Vought F8U-1 *Crusader* was originally designed as a machined part, which made quantity production excessively expensive. Now produced by Lebanon's CERAMICAST process in cast steel, the part retains the desirable characteristics of the original, at a considerable cost saving.

. . . IN THE BOTTLING INDUSTRY

To produce the surface smoothness and close tolerances of this bottling cap guide, engineers at Pneumatic Scale Co. specified CERAMICAST. The thin metal sections and accurately recessed pockets are significant advantages of Lebanon's new casting process.

. . . IN AIRCRAFT FUEL SYSTEMS

The unique advantages of the CERAMICAST process are illustrated in this jet engine fuel valve. Practically impossible to produce as a sand casting, this component is easily adaptable to CERAMICAST.

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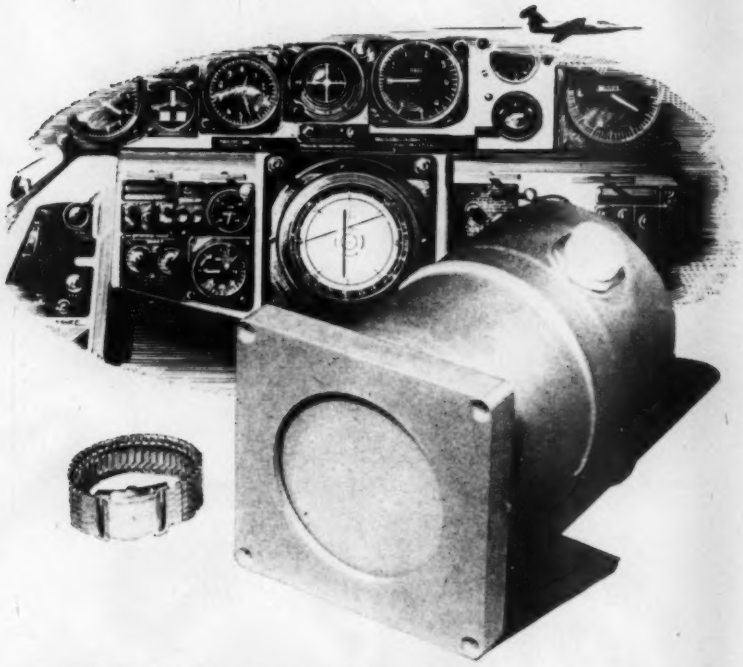

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AVIATION CALENDAR

(Continued from page 5)

Congress, 5th Atomic Energy in Industry Conference and 5th Hot Laboratories & Equipment Conference, Convention Hall, Philadelphia, Pa.

Mar. 14-15—Flight Propulsion Meeting (Classified), sponsored by IAS, Hotel Carter, Cleveland, Ohio.

Mar. 18-21—Pacific Coast Plastics Exposition, in conjunction with The Society for Plastics Industry National Conference, Shrine Exposition Hall, Los Angeles.

Mar. 18-21—National Convention, Institute of Radio Engineers, New York Coliseum and Hotel Waldorf-Astoria, New York.

Mar. 18-21—First Military Automation Exposition, New York Trade Show Building, 500 Eighth Ave., New York. For details write: Richard Rimbach Associates, 845 Ridge Ave., Pittsburgh 12, Pa.

Mar. 19-21—151st National Meeting of the American Meteorological Society, University of Chicago.

Mar. 27-29—Educational Colloquium on Radiation Effects on Materials, sponsored by Office of Naval Research and Glenn L. Martin Co., Johns Hopkins University, Baltimore, Md.

Apr. 2-5—National Aeronautic Meeting, Aeronautic Production Forum and Aircraft Engineering Display, sponsored by Society of Automotive Engineers, Hotel Commodore, New York.

Apr. 3-5—Spring Meeting, American Rocket Society, Sheraton Park Hotel, Washington, D. C.

Apr. 17-20—Eighth Annual Conclave, Arnold Air Society, including aviation equipment display, Hotel New Yorker, New York, N. Y.

May 1-3—Spring Meeting and Exhibit, Society for Experimental Stress Analysis, Hotel Statler, Boston, Mass.

May 6-8—28th Annual Meeting, Aero Medical Assn., Shirley Savoy Hotel, Denver, Colo.

May 8-11—13th Annual National Forum, American Helicopter Society, Sheraton Park Hotel, Washington, D. C.

May 24-June 2—22nd Paris Air Show, Society of French Aircraft Constructors, Le-Bourget Airport, Paris.

June 1-9—First Annual National Aviation Trade Show, Monmouth County (N. J.) Airport.

June 23-25—29th Annual Meeting, Aviation Distributors & Manufacturers Assn., The Broadmoor, Colorado Springs, Colo.

July 12-13—British Lockheed International Aerobatic Competition, the National Air Races (third round) and the King's Cup Air Race, Coventry Civil Aerodrome, Bagington, England.

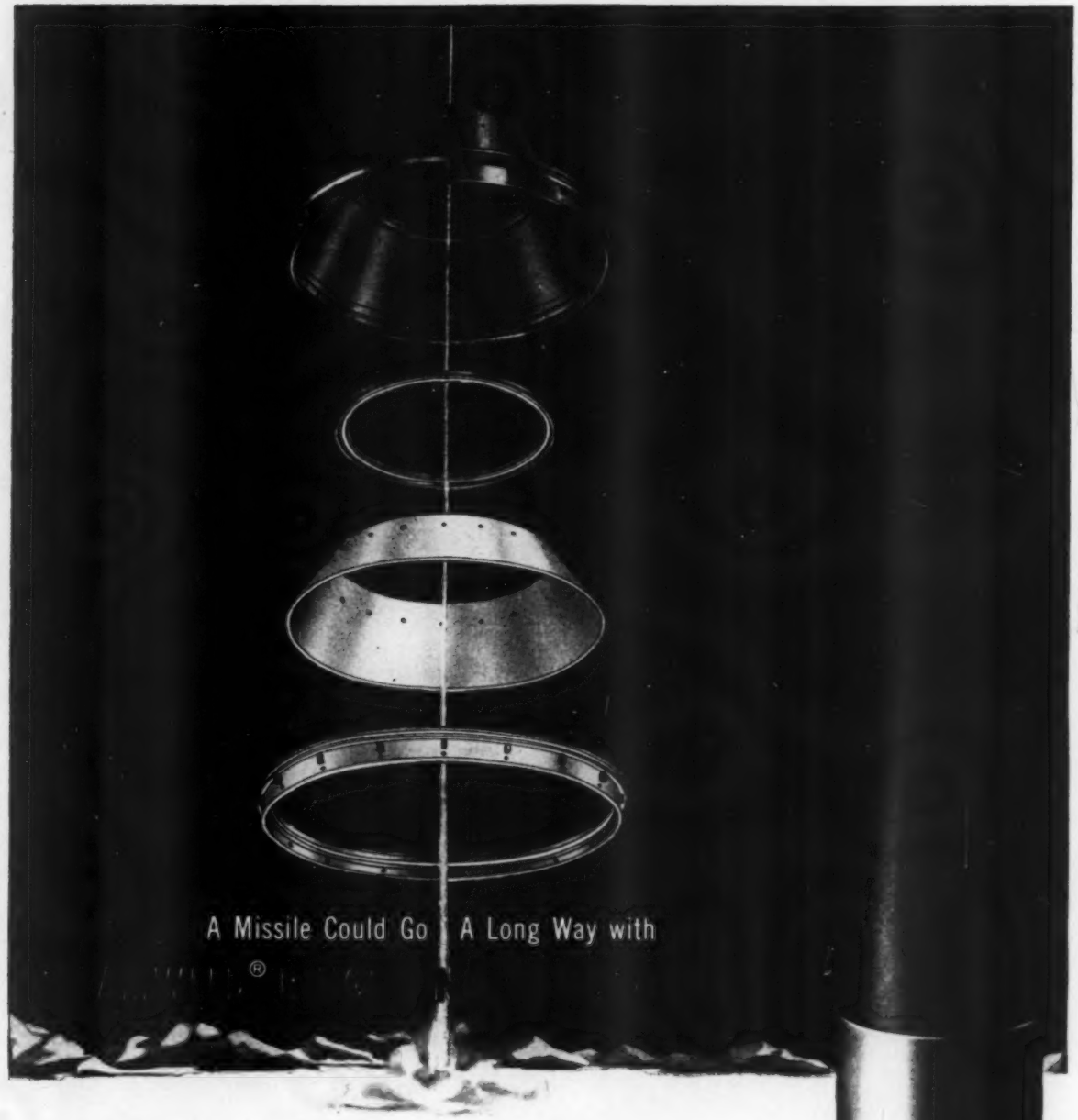
Sept. 1-6—Sixth International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Folkstone and London, England.

Sept. 2-8—1957 Flying Display, Society of British Aircraft Constructors, Farnborough, England.

Sept. 9-13—13th Annual General Meeting, International Air Transport Assn., Madrid.

Oct. 2-4—Tenth Annual Meeting & Forum, National Business Aircraft Assn., Cosmopolitan Hotel, Denver, Colo.

Nov. 18-29—Technical Conference, International Air Transport Assn., Miami, Fla.



The manufacturers of jet aircraft engines, (and American Welding supplies every major jet engine manufacturer), have learned that there is an inherent savings of material and machining time in the use of flash-welded rings and components fabricated from mill-rolled and extruded shapes.

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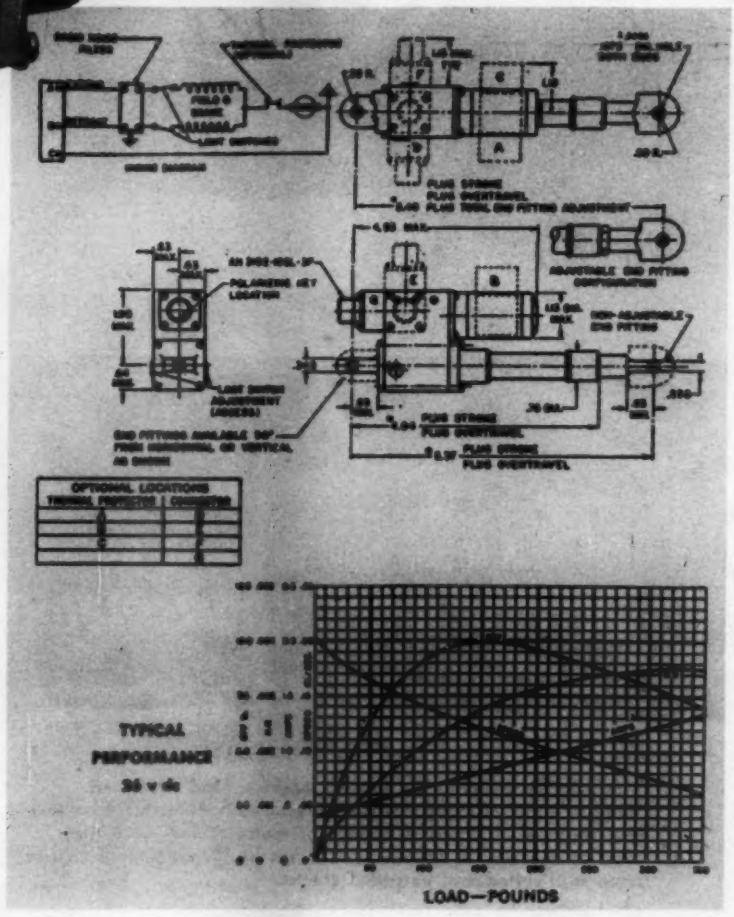

GENERAL ENGINEERING DATA:

1. 26 volt dc split field, series wound reversible, intermittent duty motor with magnetic brake. Available with thermal overload protector.
2. Unit includes limit switches externally adjustable through entire length of stroke, positive overtravel stops, overload clutch, and anti-rotation device.
3. Maximum operating load—350 lb. Ultimate static load—1000 lb. for 12 inches maximum extended length.
4. Weight 0.97 lb.
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   Plus 0.04 lb. for thermal overload protector.
5. Maximum dimensional tolerance ±.03 in. unless otherwise specified.
6. Dimensions given are minimum lengths for zero stroke. To determine minimum length for required stroke, add stroke plus stroke overtravel plus total end fitting adjustment.

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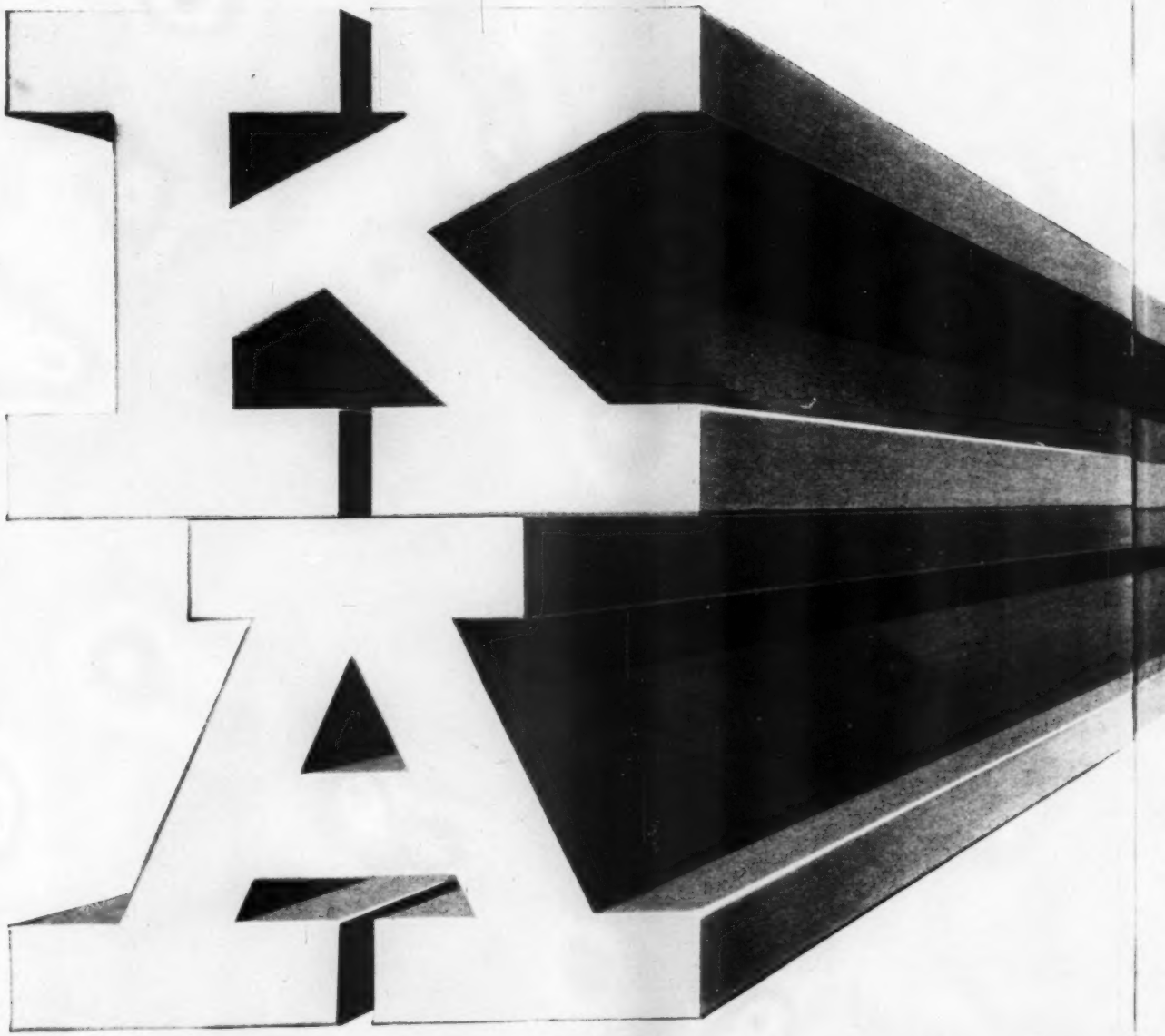

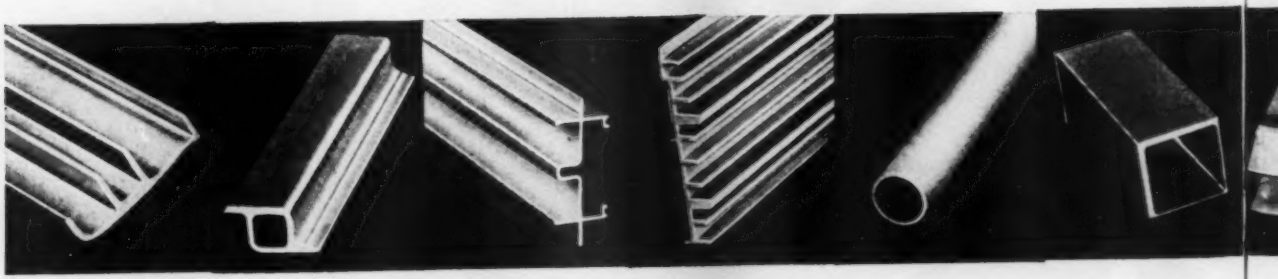

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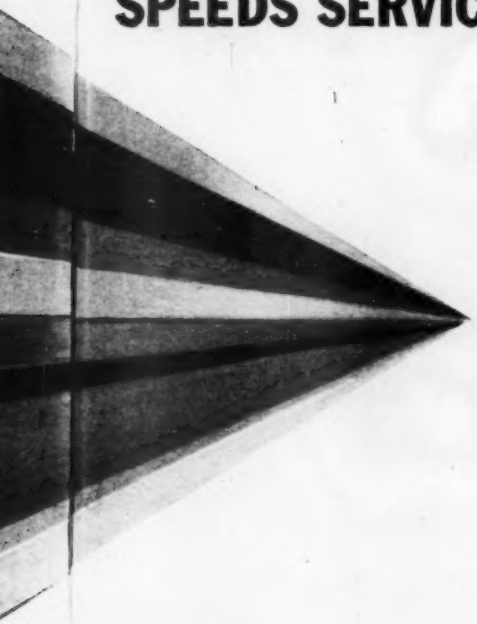

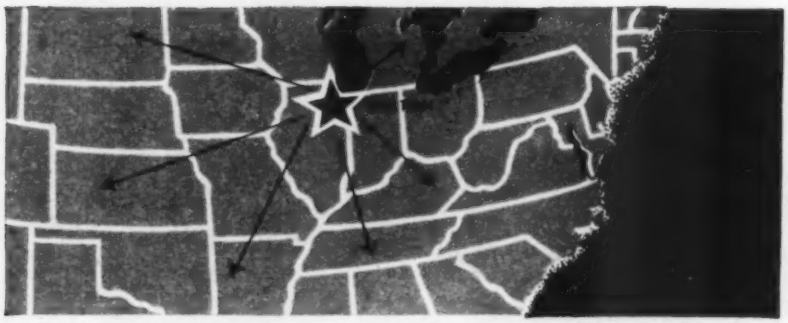

Kaiser Aluminum's new, modern extrusion plant at Dolton, Illinois now makes possible even faster service to users in midwestern industrial centers.

Strategically located in the heart of America's industrial complex, the Dolton plant's expanded production facilities assure you of an abundant, convenient supply of high quality aluminum extrusions.

Production facilities include five extrusion presses—two 850-ton presses, one 1250-ton press, one 2100-ton press and a 3000-ton press now being installed. The plant can supply 18,000,000 pounds of quality extruded shapes and tubing a year.

Modern remelt, billet casting and die making facilities, plus a 100-ton stretcher, make Kaiser Aluminum's Dolton plant one of the most complete extrusion plants in the country.

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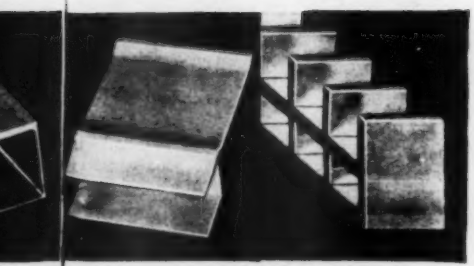
With the new plant at Dolton, *three* Kaiser Aluminum extrusion plants are now in operation to meet your increased demands.

At Halethorpe, Maryland, Kaiser Aluminum operates two other plants; one with an annual capacity of 46,000,000 pounds, the second with an 18,000,000 pound annual capacity.



Two huge 8000-ton heavy presses in the second Halethorpe facility produce hollow shapes up to 24 inches in maximum cross-sectional dimensions, and flat sections up to 32 inches wide, 85 feet in length.

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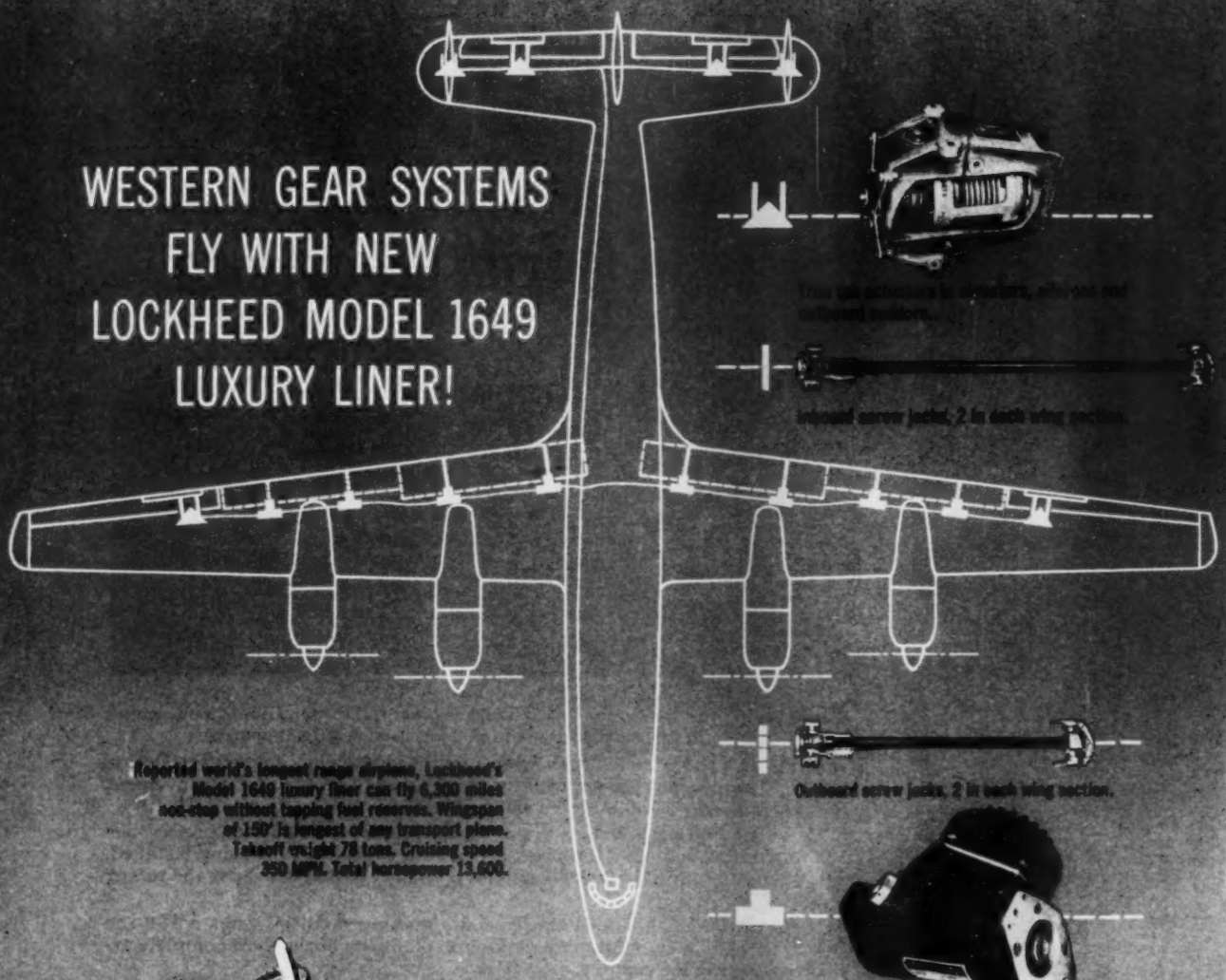
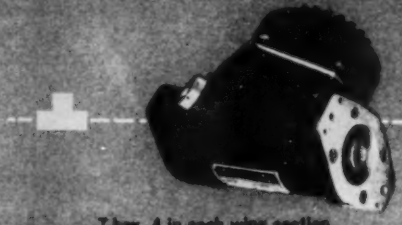
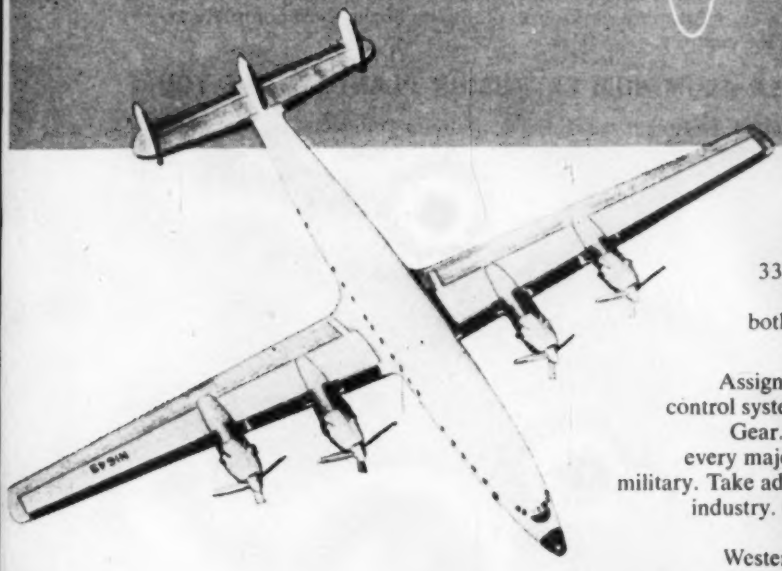


Reported world's longest range airplane, Lockheed's Model 1649 luxury liner can fly 6,300 miles non-stop without tapping fuel reserves. Wingspan of 150' is longest of any transport plane. Takeoff weight 78 tons. Cruising speed 350 MPH. Total horsepower 13,600.

Outboard screw jacks, 2 in each wing section.



T-box, 4 in each wing section.



Western Gear's wing flap system on Lockheed's newest and largest luxury liner, Model 1649, using ball screws to actuate 335 sq. ft. of wing flap area, helps in takeoff and landing. Western Gear trim tab controls on both outboard rudders, elevators and ailerons aid in maintaining steady, true flight.

Assignment to design and construct such important control systems is evidence of Lockheed faith in Western Gear. Western Gear equipment is aboard virtually every major aircraft flying today, both commercial and military. Take advantage of 40 years of service to the aviation industry. Call on a Western Gear aircraft specialist for recommendations. Address General Offices, Western Gear, P.O. Box 182, Lynwood, California.

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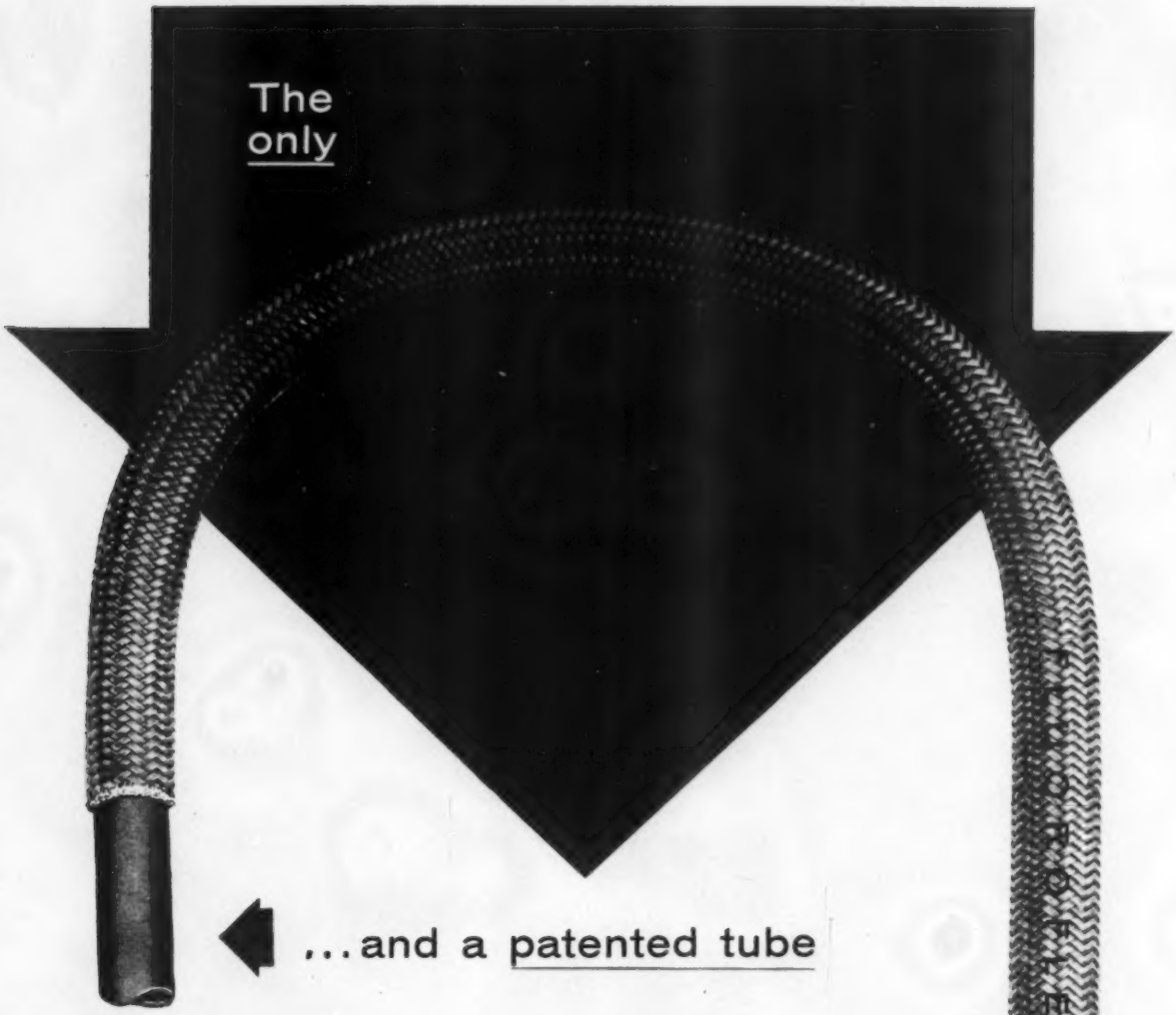

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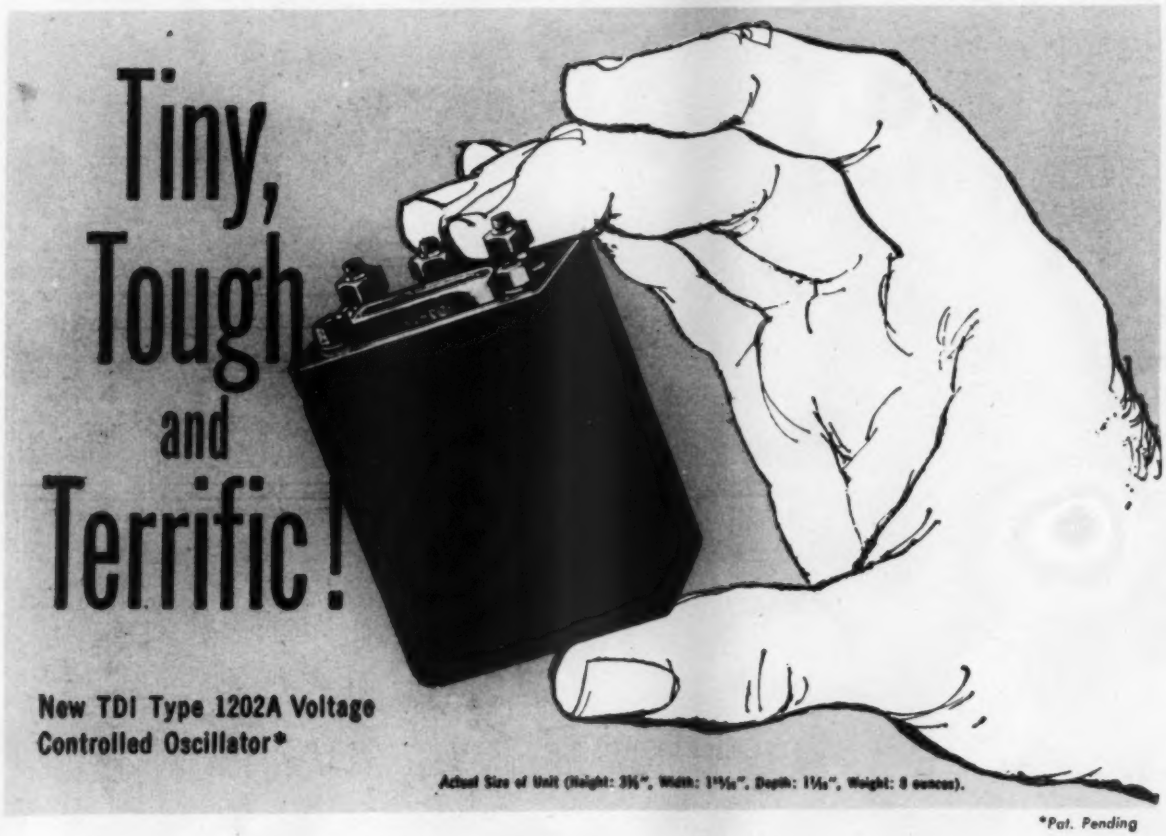

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This new TDI voltage-sensing subcarrier oscillator weighs in at only 8 oz.—is approximately one-half the size of previous oscillators—contains only two tubes, compared to present day five-tube circuits—but these are no indication of its outstanding performance! Reliability under typical (and that means extreme) environmental conditions is nothing short of amazing.

Interested? You can learn more by sending today for free technical data and detailed specifications of TDI's newest precision component for in-flight telemetering. Bulletins of other TDI remote instrumentation products sent on request.

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TEMPERATURE—Designed for operation from −65° C to +100° C

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- GROUND ELECTRONICS SYSTEMS
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Scinseal, originated and developed by the Scintilla Division of Bendix*, is a multi-purpose thermo-plastic material designed to protect and seal vital wiring assemblies from every operational hazard.

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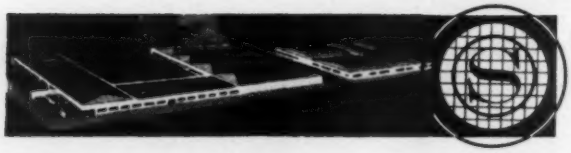

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COVER: First photograph to show the left side view of the F-104A clearly includes single Vulcan 20mm. cannon outlet under cockpit. Clean fuselage design conforms to the area rule principle, which does not necessarily demand any pinching at the waist. Powered by a General Electric J79 turbojet, the F-104A is 54 ft. 9 in. long. Spiked inlets for supersonic flight were first revealed by Aviation Week (Apr. 23, 1956, p. 35). Yaw meter hangs from nose test boom on airplane in background.

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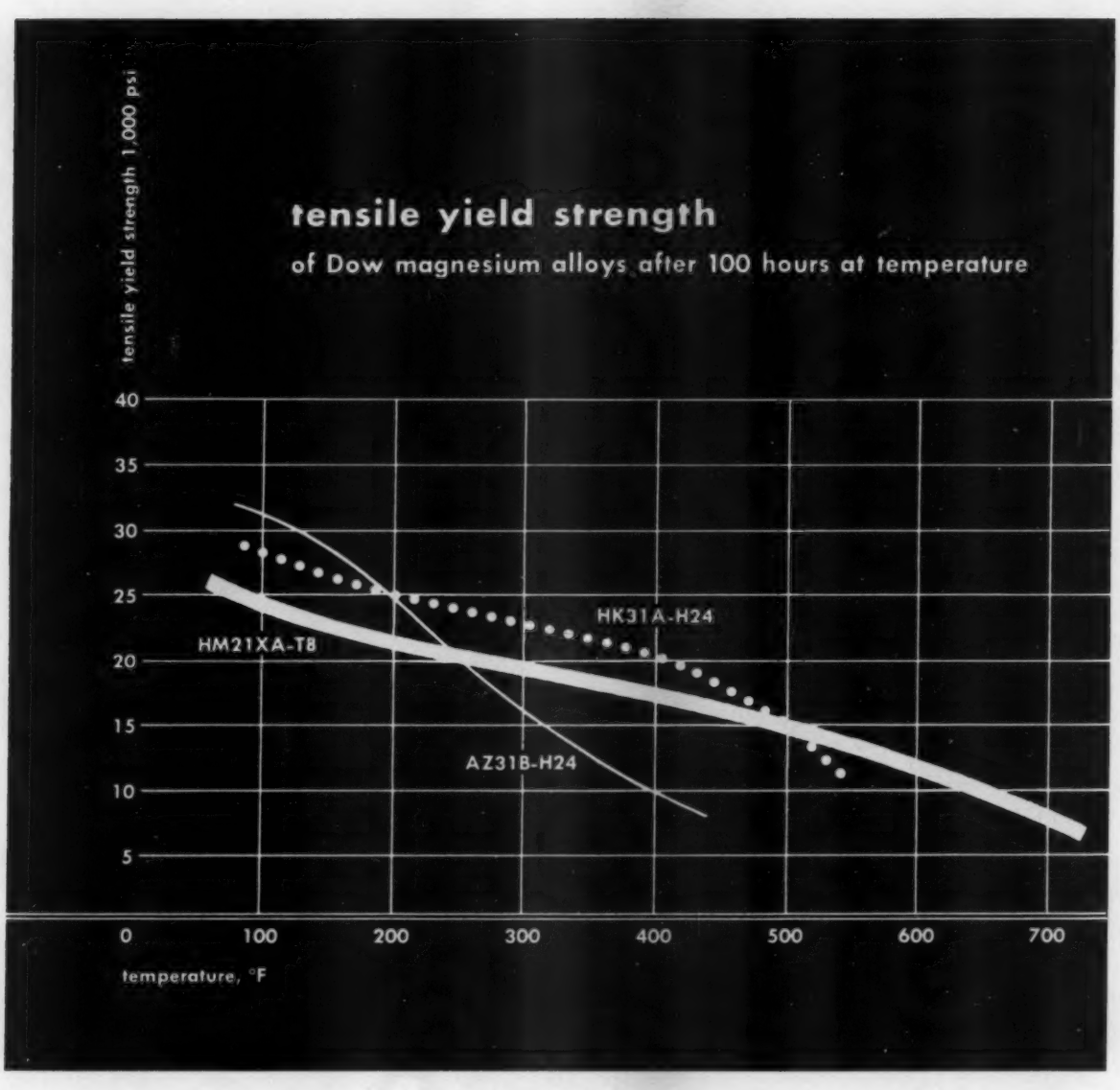

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Dow Magnesium HM21XA-T8 alloy extends further the range of conditions under which light metals can be used in aircraft design. Second in the series of sheet alloys designed specifically for elevated temperature applications, it supplements the excellent characteristics of HK31A alloy.

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YOU CAN DEPEND ON DOW

A Message From the Publisher

1957 Expansion Program

During 1956 the aircraft industry again became the nation's largest single manufacturing industry and the airlines set new records in traffic and revenue.

Aviation Week's growth during 1956 matched the pace of the industry it serves, establishing new peaks for editorial impact, paid circulation, readership preference in the top-level scientific-engineering-management groups and in advertising volume.

Under the leadership of its editor, Robert B. Hotz, an expanded editorial staff is planning continued growth to bring Aviation Week's readers the latest scientific, engineering, economic and political developments first—when they are of most value to the engineering-management executives who direct the destinies of the industry. Aviation Week now has the largest staff of graduate engineers and engineering writers in the aviation publishing field.

Plans for 1957

Among the new developments planned for 1957 to increase and improve editorial service rendered our readers are:

• **Establishment** of a European editorial office in Geneva, Switzerland, to provide the same high quality of coverage on foreign technical progress that now characterizes Aviation Week's engineering reporting in this country. The European editorial office will be directed by David A. Anderton, assistant managing editor (technical).

• **Establishment** of a southwestern editorial office in Dallas, Texas, to provide on-the-spot coverage of the fast-growing aviation complex in the southwestern states centering on the Dallas-Ft. Worth area. Craig Lewis, an experienced member of Aviation Week's Washington bureau, will head the southwestern office.

• **Expanding** technical coverage in the many new areas which aviation technology is now embracing.

• **Increased** coverage of air transport technical and economic developments by a staff seasoned with actual airline experience.

Record of 1956

Editorial achievements during 1956 included the following:

• **Air Research and Development Command** special issue published in August provided the latest information on the multibillion dollar USAF research and development program.

• **Air Transport Association's** 1956 edition of Facts and Figures on the airline industry published in April. Aviation Week will also publish the 1957 edition of Facts and Figures in its April 22 issue.

• **Missile Engineering,** a quarterly compilation of material on guided missile technology reprinted from the regular editions of Aviation Week, began publication in September as a special service to readers in this segment of the aviation industry.

• **Buyers Guide Edition for 1957** was published in December with more than 40,000 aviation products of 3,200 firms listed for easy reference by engineers, military procurement officials and management.

• **On-the-spot** editorial coverage of the Russian visit by General Nathan F. Twining, USAF chief of staff; first-hand coverage of new Soviet aircraft unveiled at the Tushino air show; and interviews with Soviet aviation leaders in Moscow.

Aviation Week will publish a special Research and Development Edition on May 27, 1957 including a special report on technical progress in Europe and Asia. During 1957 we will also produce under contract the monthly unclassified official command magazine for the USAF Air Research and Development Command.

Advertising Gains

These editorial services have brought an all-time circulation high of 64,500 net paid subscribers at the end of 1956 with further expansion planned to reach 67,000 subscribers by the end of this year. Coincident with this increase our renewal rate also reached the highest percentage in our history. T. J. Lucey, an experienced McGraw-Hill circulation man, has been named to the newly-created post of circulation manager of Aviation Week where he will develop improved subscriber service and faster magazine delivery methods.

During 1956 Aviation Week published 4,885 pages of advertising representing a gain of 586 pages over the previous year. This is the largest gain for the year among all aviation publications. The first quarter of 1957 indicates continued growth in this department under the direction of E. P. Blanchard, advertising sales manager.

During 1956 Aviation Week advanced two notches to sixth place among all business publications on the basis of advertising pages and continued to be the only aviation publication among the first 20 largest magazines in the nation, climbing from 11th to 8th in this group.

Aviation industry prospects for 1957 forecast heavy growth in research and development activity, stable production rates for both military and commercial aircraft and continued expansion for airline and business flying revenues.

—Robert W. Martin, Jr.

THERMOCOUPLES TAKE JET'S TEMPERATURE

Fenwal Harness Is Foolproof, Has Long Life

ASHLAND, MASS. — One mechanic who'd never seen Fenwal's Jet Engine Harness before installed it properly in fifteen minutes.

A fool would need a few minutes more to do the trick, but he'd have to be an idiot to get it on wrong. Fenwal makes the harness, which senses a jet's exhaust temperature with thermocouples, as simple as it can possibly be. It can be used for indication, control, or, with certain inexpensive modifications, for both.

The service-life of the harness is at least hundreds of hours in excess of Government specifications. The actual life can only be given as more than a thousand hours, since field tests were called off at that point, with absolutely no signs of failure apparent.

Fenwal pre-forms the harness to fit your engine, and the installer simply slips it around the tail cone. Only two bolts for each thermocouple lock the thermocouple to the harness and the harness to the mounting boss. All thermocouples are keyed, so that they can be installed only in the proper way.

Terminal studs have been eliminated — and vibration-induced breakage and short circuiting have been eliminated too. In place of studs are curved buttons on the thermocouples and flat buttons on the harness. These buttons make the contact between the thermocouple and the harness.

As for maintenance, nothing could be simpler. If it ever becomes necessary to replace a thermocouple, only two bolts are involved. Since the contact buttons are exposed to air flow, removal of moisture and foreign particles from them is virtually automatic. The harness itself needs no care, since it is sheathed in stainless steel, and the bus bars are insulated with a special hard asbestos.

RELIABLE AND FOOLPROOF — This Fenwal Jet Engine Harness senses jet engine temperatures with interchangeable thermocouples for indication and control purposes. It is exceedingly simple to install. It has been service tested for 1000 hours without failures.

You don't have to worry about the effects of differential expansion on the harness, either. The assembly is semi-flexible, and puts only light stresses on the bosses. The bosses don't have to be "beefed up."

The system performs at ambient temperatures up to 1200°F, and Fenwal is prepared to make systems for higher temperatures on request.

It is remarkably light. A four-thermocouple system with a 21-inch diameter harness, for instance, weighs only 3.6 pounds, bolts and all.

You will have no trouble integrating the system with your own indicator or control schemes, or both. The circuitry is simple, too, with balancing resistors in the thermocouple mounting pads for maximum control accuracy. Tolerances are such that no adjustments are needed when a thermocouple is replaced.

Contact your local Fenwal Sales Engineer, or write to Fenwal direct to learn how this system and other widely useful Fenwal concepts can solve temperature control problems now facing you. **Fenwal Incorporated, Aviation Products Division, 122 Pleasant Street, Ashland, Mass.**

Fenwal

CONTROLS TEMPERATURE ...PRECISELY

WHO'S WHERE

In the Front Office

William C. Jordan, aircraft manufacturing executive, a director, Solar Aircraft Co., San Diego, Calif.

Fred M. Glass, of the Empire State Building Corp., a director, New York Airways, Inc., New York, N. Y.

Boyd S. Oberlink, a company group vice president, a director, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

James M. Johnston, senior partner of Johnston, Lemon & Co., a director, Atlantic Research Corp., Alexandria, Va.

Alois W. Graf, Chicago attorney, a director, Waters Manufacturing, Inc., Wayland, Mass.

Harry E. Pinkerton, president, Intercontinental Electronics Corp., Mineola, N. Y.

M. W. Tuttle, vice president and general manager, Radioplane Co., subsidiary of Northrop Aircraft, Inc., Van Nuys, Calif.

George E. Hawkins, executive vice president, Air Reduction Company, Inc., New York, N. Y.

Edmund B. Buster, vice president and general manager, Cherry Rivet Division, Townsend Co., Santa Ana, Calif.

Charles S. Rockwell, vice president and general manager, Ford Instrument Co., division of Sperry Rand Corp., Long Island City, N. Y.

L. E. Dalton, vice president-manufacturing, Kelsey-Hayes Co., Detroit, Mich.

Honors and Elections

Carl Brady, a partner in Economy Helicopters, Yakima, Washington, has been elected president of The Helicopter Association of America, New York, N. Y.

C. J. Reese, president of Continental Motors Corp., has been elected 1957 chairman of the Aircraft Industries Association's Utility Airplane Council. Mr. Reese succeeds Dwane L. Wallace, president of Cessna Aircraft Co.

Changes

Edward A. Beaupre, contract manager and assistant to the president, Electronics Corp. of America, Cambridge, Mass.

Leo Seybold, assistant to the president, Air Transport Association of America, Washington, D. C.

J. F. McBrearty, assistant general manager-commercial aircraft projects, Lockheed Aircraft Corp., Burbank, Calif. Also: **Robert A. Bailey**, head-new advance systems research organization, and **Allen Maver** in charge of program of military aircraft sales to friendly foreign countries.

Basil Blackwell, assistant chief engineer, Bristol Aero Engines Limited, Bristol, England.

John H. Carter and **Stanley W. Burries**, managers, Lockheed's Missile Systems division two newly established weapon system organizations, Van Nuys, Calif.

Joseph J. Jerger, director of engineering, National Water Lift Co., division of The Cleveland Pneumatic Tool Co., Kalamazoo, Mich.

INDUSTRY OBSERVER

► Watch for USAF decision soon on the medium range interceptor competition with North American having the inside track to get the contract. Lockheed, Northrop and Convair are the other competitors. The medium range interceptor will be put into production instead of the long range interceptor category for which North American and Northrop were competing before the project was scratched by USAF due to a shortage of research and development funds.

► **Second Convair B-58 Hustler supersonic medium bomber is scheduled for its first flight next week at Ft. Worth.**

► Grumman F11F-1F powered by the General Electric J79 turbojet is being considered as an MDAP program interceptor to bolster defenses of NATO countries. This J79 powered version of the Tiger has flown more than 1,220 mph. and reached altitudes above 72,000 ft. in flights at Edwards AFB (AW Dec. 24, p. 26).

► **Range of Convair Terrier, ship-based anti-aircraft missile to become standard armament for Navy frigates, will be increased to 20 miles instead of its current ten-mile reach.**

► At least four research projects in the cryogenics field are being carried out by the western branch of Fairchild Airplane and Engine Corp.'s Stratos Division. This low temperature research will include systems, controls and valves for both missiles and aircraft.

► **Strategic Air Command is scheduled to receive its first Boeing KC-135 jet tanker in April. Aircraft will be delivered to Castle AFB for test purposes. Two of the tankers are expected to be operational by early next year.**

► Army has sent out instructions for H-21 pilots make running landings and takeoffs whenever possible when operating on asphalt pavements. Helicopter's landing gear is designed so that the wheels move outward on landing, causing a high shearing stress in the upper portions of the pavement.

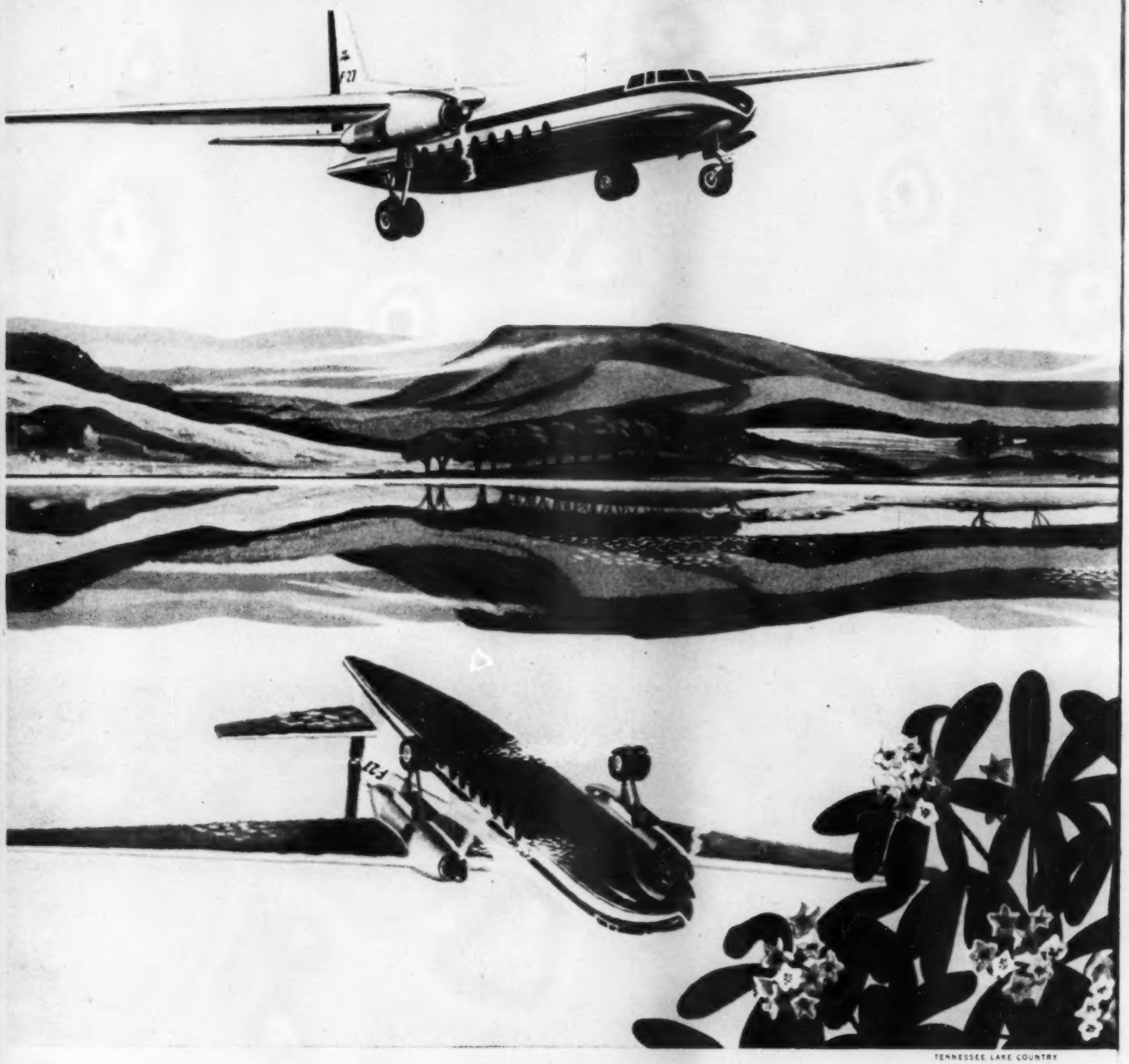
► **Royal Canadian Air Force is interested in the Vickers Vanguard as a possible replacement for its four-engine North Stars. The North Star is a Canadair-built aircraft combining the features of the DC-4 and DC-6 and is equipped with Rolls-Royce Merlin engines.**

► Stratos Division of Fairchild Engine and Airplane Co. has developed an arming solenoid for unpressurized service at 80,000 ft. Next step in the Stratos program will be to check the unit for operation at altitudes above 100,000 ft.

► **Sidewinder test firings against drones flying low over desert areas have shown that the reflected heat has produced no problems with the missile's infrared homing system. Some concern had been felt that large heat masses would "jam" the seeker.**

► Fate of Westinghouse J54 turbojet, privately financed by the company, hangs in the balance pending a possible high-level decision on its future. Neither USAF nor Navy has a plane scheduled to take the 6,750 lb. thrust engine. Defense Department, concerned over narrowness of powerplant portion of U. S. aircraft industry, is considering alternate means including subcontracting to keep Westinghouse Aviation Gas Turbine Division a going concern.

► **Canada's Department of Defense Production has prepared a letter of intent for the CL-44, a transport version of Canadair Ltd.'s CL-28 maritime reconnaissance aircraft. Though it does not mean a contract is a certainty, letter does denote formal interest in the project. Instead of Bristol Proteus engine used in Britannia, from which CL-28 is derived, Canadair is considering use of the Bristol Orion or Rolls-Royce Tyne engine, the Orion currently favored because of a power potential above its rated 5,050 eshp.**



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Reflecting a new peak in air travel

The Fairchild F-27 propjetliner represents a major advance in regional air transport . . . the attainment of new peaks in performance, passenger comfort, all-around economy.

Performance: 280 mph cruising, superb small-field characteristics.

Passenger comfort: spacious cabin, pressurized and air-conditioned; the F-27 permits unobstructed views from the panoramic windows.

Versatility: the F-27 in its executive transport version matches the features of its airline sister ship – is unmatched by any corporation airplane in its class, with range to 2,250 miles.

Economy: – pays its way on hops of less than 100 miles. It's inexpensive to run, to maintain, to buy:

Address inquiries to: R. James Pfeiffer, Executive Director of Customer Relations, Fairchild Engine and Airplane Corp., Hagerstown 15, Md.

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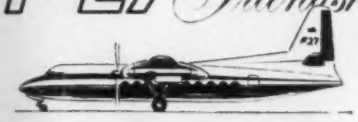
F-27 *Friendship*



THE FINEST AIRCRAFT FOR AIRLINES, CORPORATIONS AND MILITARY SERVICES.

Washington Roundup

Guided Missile Probe

The House Armed Services Committee will soon begin a comprehensive review of the guided missile roles and missions assigned to the three services last November by Secretary of Defense Wilson (AW Dec. 3, p. 30). The main objective of the review, according to committee chairman Rep. Carl Vinson (D.-Ga.), will be to determine whether the Wilson assignments are consistent with the roles and missions assigned to the services by legislation. Vinson said that "congressmen have been circulated with memos" on the Wilson assignments. The memos presumably were prepared and circulated by Army officers disgruntled over the Army's being denied operational intermediate range guided missiles.

Atomic Impact

The degree to which the atomic age is affecting the armed services is indicated by the Atomic Energy Commission's 21st semi-annual report to Congress. The report notes that five military reactors have been built, 15 are under construction and 23 more are planned. Uses will range from propulsion of aircraft (see page 29), ships and submarines to transportable power packages for remote military installations. The AEC already has spent $138 million on aircraft reactor development and $273.3 million for naval propulsion plants.

On the weapons side, AEC said tests in the Pacific last year produced important information on reducing fall-out from firings, on weapons for defensive purposes and on "new design principles which will lead to more efficient weapons that can be more effectively employed" —possibly a reference to smaller thermonuclear warheads for missiles.

Accelerated weapons work has made 11 expansion projects necessary. They include:

- **Additional** "laboratory, fabrication and experimental structures" at the University of California's Radiation Laboratory, Livermore, Calif., and ordnance engineering facilities for Sandia Corp. adjacent to the Radiation Laboratory.
- **A range for determining** "ballistic characteristics of inert weapons shapes dropped from aircraft." Construction is under way. Location is to the northwest of the Nevada test site.
- **Expansion of two ordnance plants,** construction of new laboratory facilities at Los Alamos Scientific Laboratory, and expansion of the Sandia Laboratory, the Kansas City Plant and the South Albuquerque works.

Twining Views Budget

Air Force Chief of Staff Gen. Nathan F. Twining made his first public statement on the Fiscal 1958 budget last week. His verdict—he will accept the budget that will reduce the Air Force by at least 14 wings, but he thinks it should be higher.

In testimony before the House Armed Services Committee, Gen. Twining referred to President Eisenhower's statement that the budget would provide "a wise and reasonable degree" of protection and added: "I accept this judgment, and I support the force structure I have outlined."

The proposed force structure, as detailed by Gen. Twining, would strip the Tactical Air Command of six wings —one B-45 medium bomber, two fighter-bomber, and three day fighter wings. The Air Defense Command will lose two fighter interceptor wings that had been planned but not activated, and six fighter wings will be dropped from the inventory of the Strategic Air Command.

Gen. Twining hedged his acceptance of the budget and wing reductions by saying he "would naturally feel more confident if the resources available to the Air Force permitted more rapid modernization of aircraft and supporting equipment and a faster rate of improvement of our base and support systems.

"However," he added, "I recognize that there is an element of risk in any military program."

He told committee members that four more heavy bomber wings will be converted to Boeing B-52 Stratofortresses during Fiscal 1958, cutting the B-36 wings to three and raising the B-52 wings to eight, with 45 aircraft in each wing.

U.S. Missiles for Britain?

U. S. missile manufacturers can expect to see their designs being used for the defense of Great Britain. For the industry, this probably will be the most important result to come from last week's initial conferences between Pentagon brass and British Defense Minister Duncan Sandys.

One good bet: The Sidewinder, Navy's air-to-air guided missile, will be used to give current English interceptors acceptable combat capability.

Defense Secretary Charles E. Wilson was the key American to attend the Washington conference. Also attending was USAF Secretary Donald E. Quarles, who was Assistant Secretary of Defense for Research & Development in 1954 when the original agreement was signed to promote exchange of information on guided missiles between the U. S. and Great Britain.

Sandys says he would like to see the agreement broadened, presumably to help England get needed hardware and, at the same time, cut down on expenses.

'Airspace' User Charges?

Airways and airport user charges will draw more serious attention this year, with the possibility that Presidential Aide Edward Curtis may propose the adoption of a user charge program in his recommendations to the White House late this spring for an airways and air traffic control system.

In his budget message, President Eisenhower advocated "air-space" user charges, and Curtis in a recent speech proposed both airways and airport user charges. Curtis said he thought it only fair that a "portion at least of the cost of operating" such facilities should be carried by the users. He hinted at user charge formula when he said, "These user charges should bare some relation to the type and extent of service received and to ability to pay."

Curtis added that the federal aviation fuel tax is a "step in this direction but additional revenue of this type should be given consideration." Curtis feels that the present system of federal support of the airways and local state and municipal support of airports is proper but he would like to see further study of the extent to which federal funds should be made available for aid in local airport development.

—Washington staff

1965 Weapons Need

LOCKHEED X-17, shown here in first pictures, is three-stage solid-propellant rocket designed to simulate re-entry conditions for ICBMs and IRBMs. Missile is spin-stabilized at launching; flared tailcones of second and third stages provide stability. X-17 takes off (right) from launch pad at Air Force Missile Test Center, Cocoa, Fla. Spin rockets have already fired and missile is rotating. Vehicle was rapidly developed to meet critical need in ICBM program. NACA has done parallel work with four-stage rockets assembled from stock solid-propellant units (AW Oct. 15, p. 26 and Oct 22, p. 52). Nose in foreground is Northrop Snark.

New York—Weapon systems for 1965-1970 cannot be delivered unless adequate funds are provided now for research and development.

This warning was sounded by Dr. Courtland D. Perkins, Chief Scientist for USAF, at the 25th annual meeting of the Institute of the Aeronautical Sciences.

Stabilized budget ceilings now in force are not compatible with the mounting cost and complexity of weapon systems, Perkins indicated. Competent and rapid evaluation of weapons, combined with reduced system complexity, will go a long way toward solving the problem.

But improved understanding of research and development in the upper political echelons must come along with those solutions, he said.

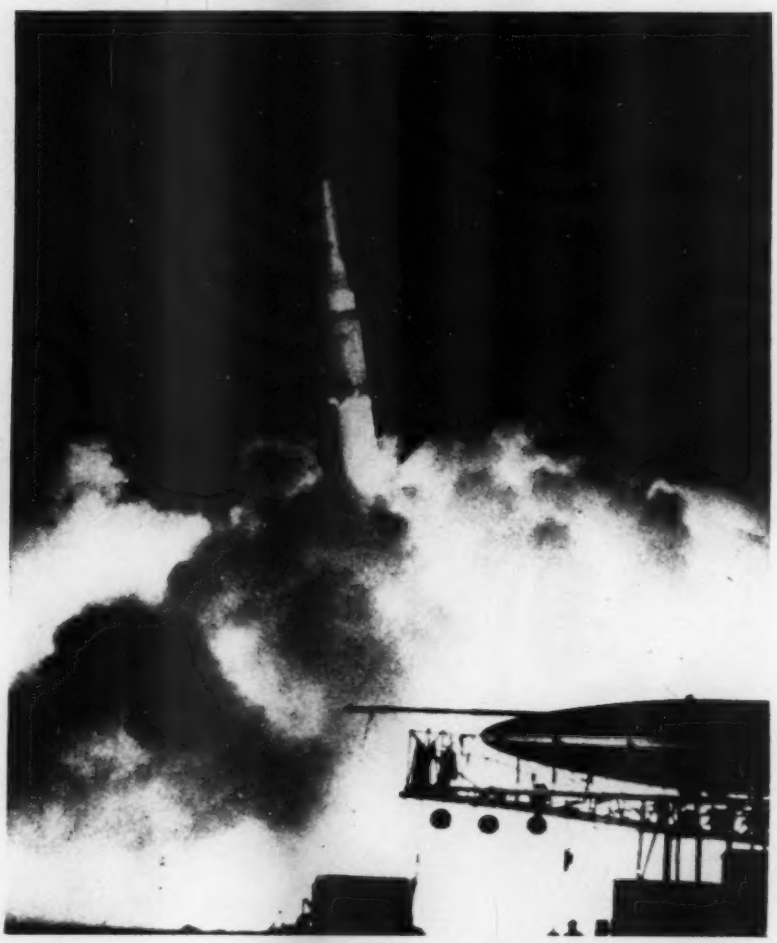
Perkins' criticisms are the latest of a series that began when Trevor Gardner, then Assistant USAF Secretary for Research and Development, resigned in protest against fund limitations on research and development for future weapons (AW Feb. 13, 1956, p. 28). One of the reasons cited for the Gardner resignation was his criticism of the constant-level budget.

Before Gardner resigned, AVIATION WEEK said editorially in its issue of Jan. 2, 1956:

"The most dangerous of these concepts is that of the 'constant level research and development budget.' . . . If we fail to maintain a superior pace of scientific development with an adequately expanding research and development budget, we will not only jeopardize the billions to be spent on future aerial weapons systems, but we will also fatally undermine the future of this country as a free nation."

Guided Missile Report

Further evidence on the cost spiral was presented by Rear Adm. John E. Clark, Director of Guided Missiles in the office, Chief of Naval Operations, in a joint military report on guided



Adequate Funds for Research Now

missile development. Clark said:

"We have failed in the area of dollar cost. Our missile unit costs are rising even after we have placed them in mass production."

New official details on some of the test vehicles and missiles in the military programs were presented in a special report to the Institute given by Lt. General James M. Gavin, Army chief of research and development; Maj. General B. A. Schriever, commander of Western Development Division, Air Research and Development Command, and Adm. Clark.

Gavin made the first official announcement of the Martin-built, Cornell-developed Lacrosse missile (see p. 31) for close support of ground troops, confirming earlier details and drawing (AW July 11, 1955, p. 9 and Sept. 17, p. 27).

Gavin also made an informal plea for increased airlift and air reconnaissance capability for the Army in remarks before his formal presentation.

Three test vehicles for USAF missile programs were described—two of them officially for the first time—by Schriever:

- **Lockheed X-7** ramjet vehicle (AW Aug. 6, p. 455) used to flight test Marquardt ramjets for the Boeing IM-99 Bomarc interceptor missile.
- **North American X-10** Navaho test vehicle, a turbojet-powered canard airframe for development of missile guidance and control (AW Feb. 15, 1954, p. 11).
- **Lockheed X-17** re-entry test vehicle (AW May 21, 1956, p. 23) used to simulate re-entry conditions and get data for ICBM and IRBM missile design.

IAS COVERAGE

The 25th Annual Meeting of the Institute of the Aeronautical Sciences was covered by an Aviation Week editorial team consisting of David Anderton, Philip Klass, Robert Cushman, George Christian, Russell Hawkes, and Robert Stanfield.

Bell's Rascal air-to-surface missile was pictured publicly for the first time in films accompanying Schriever's talk.

Reliability and cost of guided missiles are the two big problem areas today, said Adm. Clark. He indicated that there is reason to be completely satisfied with the way in which missile airframes have been developed and gotten into the air, but that there should be much less satisfaction with their reliability status.

There has been complete failure to get missile costs down, Clark said, and the fault lies jointly on contractor and the contracting agency.

Clark said that often the contracting agent insisted on following outdated specifications and standards. He cited delays in the decision-making machinery and the pumping in of changes as other agency faults. He offered six suggestions as possible means of reducing cost:

- **Design with cost** in mind from the start.
- **Design with producibility** in mind from the start.
- **Eliminate the frills** in the supporting equipment.
- **Put the man back** in the missile loop where possible; he's more reliable than a black box.
- **Reduce the number** of parts in missiles and equipment.
- **Design as if the missile** were going to be sold on the competitive market like household appliances.

Other highlights of Clark's talk:

- **Navy has the** Chance Vought Regulus I as standard armament available on 10 carriers, four cruisers and two submarines. Other submarines have the capability to guide, but not launch, the Regulus. In tests, control of the missile has been passed from sub to sub and from sub to cruiser over distances on the order of 100 miles. Regulus 2 will go on the same ships.
- **The cruiser** USS Galveston will be the first Navy ship to be armed with Talos missiles. The earlier Terriers, now on the USS Boston and Canberra, will become anti-aircraft armament for frigates in the future and the Tartar will arm destroyers against aircraft.

Propulsion

A 50% increase in chemically fueled rocket performance can be expected as a maximum future improvement, John Tormey, Rocketdyne Div., North American, told the gathering. He based

BELL RASCAL GAM-63 is designed for bombardment of ground targets from drop points well out of reach of enemy fighters or missiles. Range of rocket-powered GAM-63 is better than 100 miles; speed is about Mach 1.5. This first picture of the new missile shows its canard configuration; the lower fin has not been assembled to the vehicle. Bell-built rocket engine has three cylinders in vertical line. Bell Aircraft has recently received two contracts totaling more than $22 million for research and development work on Rascal.

NORTH AMERICAN X-10 test vehicle for Navaho long-range missile, resembles earlier missile configurations. Canard layout has since given way to single delta wing with large dihedral supplying lift, stability and control.

this upon the gap between present specific impulses near 250 seconds and his calculated maximum value of 373 seconds. Tormey arrived at 373 seconds by selecting the best possible combinations of known chemical propellants, regardless of practicality.

The fuel-oxidizer combination which he found best was fluorine and hydrogen with a molecular weight of 8.9 and a combustion temperature of 5,100F. The problem is to avoid a combination in which molecular dissociation robs the rocket of propulsive energy and to achieve the lowest possible exhaust products molecular weight.

The analysis was limited to "happy" molecules which released their energy by breaking valence bonds and did not include free-radical types of chemical fuels which are said to give specific impulses from 600-4,000 seconds (AW Dec. 3, p. 27).

Tormey indicated that the trend would be away from regenerative cooling because these higher energy fuels would be less stable when used to soak up nozzle heat.

Aircooled hollow turbine blades are used in the Rolls-Royce Conway bypass engine because of the 1,900F turbine inlet temperature necessary to keep specific fuel consumption or engine weight low.

A. C. Lovesey and L. G. Dawson of the British engine firm told the IAS that a bypass engine can give a specific fuel consumption of 0.83 compared to the 0.88 figure for a pure jet. Conversely, a bypass engine permitted the same fuel consumption would weigh less than 80% of the pure jet. These figures were for a bypass air ratio of one-third, and include pod drag.

Two percent of the engine air is diverted through the hollow blades and turbine nozzles.

Rolls has developed a technique for forging these blades.

A further advantage of the bypass is that its fuel consumption does not in-

FLIGHT TESTS OF X-10 have been made for about four years, first at Edwards AFB and more recently concluding the program at Patrick AFB. Powerplant of X-10 is pair of Westinghouse J40 turbojets. Landing attitude here approximates normal level flight attitude of vehicle. Speed is supersonic; flight tests check out aerodynamic, guidance, stability and control parameters.

crease so markedly during lower thrust demands of holding in air traffic. At 15,000 ft. and 250 kt., a bypass engine would use 8% less fuel.

In discussion the Rolls engineers stressed that the bypassing of a portion of the flow gives the designer an additional degree of freedom. By varying the nozzle on the bypass flow independently he can improve engine matching and get very good engine handling characteristics. This would be especially true if he used entirely separate nozzles for the prime and secondary flows.

Materials

"Materials have become truly a key to progress in aeronautics," Brig. General Marvin C. Demler told the session on materials.

The avionics engineer, aerodynamicist, powerplant designer, systems engineer, nuclear scientists—all have a common prerequisite: availability of materials to meet their unique requirements.

Dual denominators which thread through the materials' requirements of each of these men are resistance to heat and radiation.

Today's planes are flirting with the thermal thicket. Tomorrow's nuclear-powered weapons systems are faced with many still unsolved problems of radiation resistance.

Temperature Properties

General Demler, Deputy Commander for Research and Development of the Air Force's Air Research and Development Command, pointed out that "aircraft materials must retain their properties at temperatures ranging from near absolute zero up to several thousands of degrees Farenheit, be immune to corrosion, withstand crushing forces, be unaffected by strong thermal and nuclear radiation; yet they must be available, workable and easily fabricated."

The potential road block to future weapon systems development was underlined by W. Kniffin, Equipment and Materials Division, ARDC, who said, "the standard rate of effort in materials R&D has not been able to keep pace with the need. Results are big problems in materials application and utilization. A serious industrial impasse could result unless timely solutions can be found. . . .

"There are those who believe that materials capability will not catch up with requirements until aeronautical progress slows down as the light speed barrier is approached."

Among the many problems hampering new material development is long development time.

Titanium took ten years to reach its current, far from fully developed, state, and that was under a forced draft program.

Studies to produce metals with much greater tensile strength and heat resistance have produced encouraging results. Fine "whiskers" of pure iron with an approximate tensile strength of 2,000,000 psi. can be made. (Maximum tensile strengths of today's strongest steels is in the 300,000 psi range.)

Melting points of some refractory materials have been increased by well over 1,000C by applying pressures of 200,000 atmospheres.

Dense Phase

Most minerals have the capability of existing in a more dense phase at high pressures and temperatures. Sometimes, as in the case of synthetic diamonds, the dense phase will "fix" and remain stable when pressure and temperature are reduced to normal. This approach may open the door to entirely new families of materials.

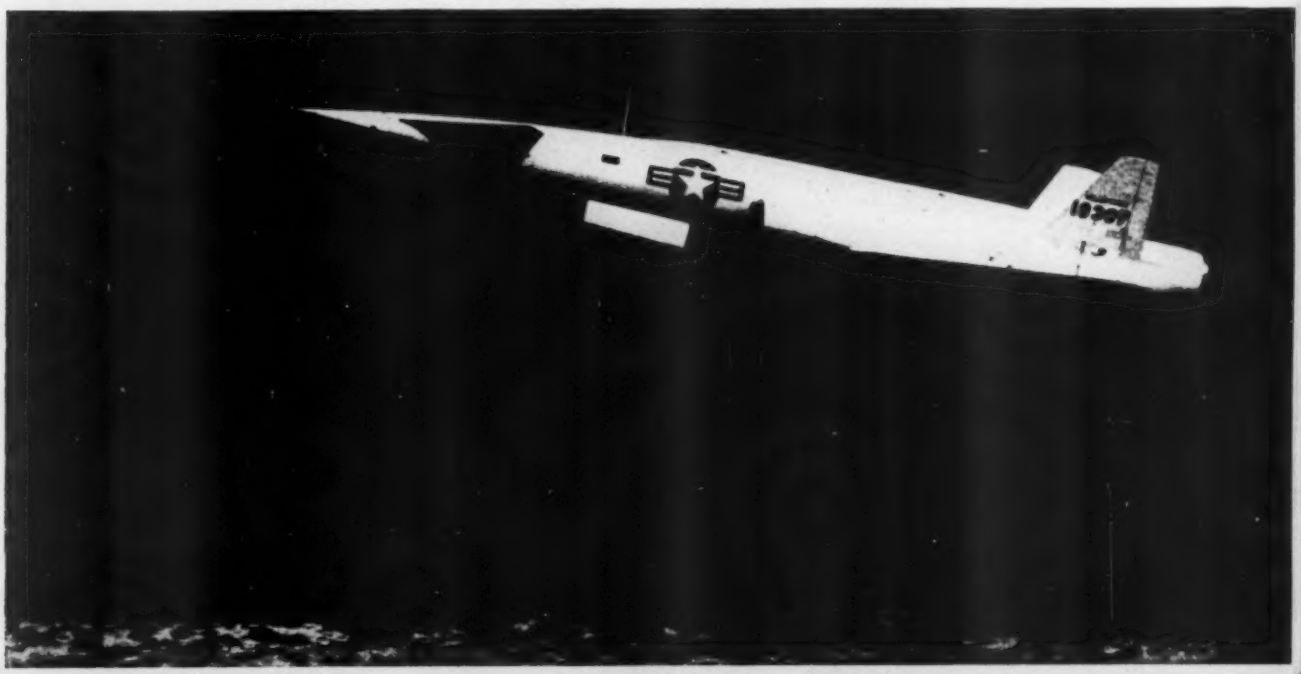
Materials which have good heat resistance are usually very hard and therefore difficult to machine. This means that plastic forming techniques, such as forging, extrusion and casting, must be further developed and refined.

Aircraft materials seem to evolve from engine to airframe. Steels used in today's airframes were standard materials in yesterday's piston engines. Similarly, present rocket materials are

Nuclear Turbojet

Washington—A turbojet engine has been "powered exclusively by heat from an experimental reactor," the Atomic Energy Commission reported last week. The experiment marked the first time that nuclear power has been applied to an aircraft propulsion unit.

The AEC said that, although "this reactor-turbojet engine combination was a laboratory model," its operation "marked a significant advance toward the ultimate goal of achieving atomic-powered flight." The experiment was carried out on the ground at the National Reactor Testing Station, Idaho Falls, Idaho.



undoubtedly the airframe materials of the future.

Nuclear-powered aircraft will require large amounts of shielding to make them inhabitable for the crew (AW Aug 6, p. 168). When nuclear fission reaction occurs, approximately 10% of the released energy is given off as fission products, alpha particles, beta and gamma rays, neutrons and a host of other products.

Materials most resistant to radiation include: the common structural metals and ceramics; phenyl silane hydraulic fluid; polyester, phenolic and epoxide-phenolic structural plastics or adhesives; and plastics known as polyvinyl carbasole-polectron and polystyrene-amphenol.

Radiation quickly attacks such non-crystalline materials as: most greases, lubricating and hydraulic oils; natural and synthetic rubbers; and textiles. Among the more radiation-resistant of this group are: natural rubber, mineral engine oil, MIL-L-7808 Anti-Rad hydraulic fluid, JP-5 fuel, Dacron fabric and two types of nylon webbing (Type XIII OD and Type VI OD), and leather. The olive drab dye used on the nylon webbing possibly acts as a radiation damage inhibitor.

VTOL/STOL Aircraft

Two VTOL problems discussed were the need for special powerplants and easier pilot controllability.

Special engines will accelerate the advent of widespread VTOL, Peter G. Kappus, General Electric's Flight Propulsion Laboratory, Cincinnati, Ohio, told the session. Kappus felt that while VTOL designers have been quick to bring out a variety of airframe designs, there has not been enough imaginative thought directed towards trying to integrate the powerplant into the best possible VTOL. Among his solutions he proposed a jet-powered craft which would take off by deflecting its exhaust down through a tip turbine ringed around the circumference of a large horizontal ducted fan in the plane's belly. Thus the energy of the powerplant's gas producer would be used to accelerate a larger mass of "bypass" air downwards for vertical takeoff.

This expedient would be one way of using the gas energy to provide a high speed jet for translational flight and have a large slow moving jet for low specific fuel consumption in vertical flight. It would increase the hovering efficiency by one-third to one-half. Kappus' study indicated this sort of craft might cruise at 400 kt. and have a radius of 1,789 mi. It is to be assumed that GE would recommend using the T58's gas producing section which, because this engine is a free turbine, can be lifted out of the turboshaft and used with only minor modifications.

Kappus did not elaborate on how airframe designers could work long ductwork full of high-temperature gas through their aircraft.

The easiest sort of VTOL to fly is the one with a conventional airframe which uses rotating engine thrust for vertical ascent, according to Bell Aircraft's James A. O'Malley, Jr. O'Malley feels that stability has been the neglected quantity in VTOL analyses. Tail sitters, which do their transition from vertical to horizontal flight at constant altitude show disturbing trends towards increasingly severe aerodynamic instability in the transition region.

When fully automatic stability control is used the price is a marked decrease in overall reliability.

But a more or less conventional VTOL airplane which rotates its engine thrust to lift itself off vertically and then rotates it back to horizontal for forward flight can be flown directly by a pilot provided that control jets located as far out as possible on the wings and tail are tied in with the regular aerodynamic controls.

This becomes even truer as the size of the VTOL is increased and its natural response time is correspondingly lowered.

O'Malley suggested that the best form of supplementary control jets would be those located near the ailerons and tail controls and fed with compressor bleed air. These could be actuated with the same control linkages used for the aerodynamic control surfaces because the moment arm would be large the control jets would not have to be especially large in thrust level.

Bell's little experimental VTOL craft, described in the 1956 annual meeting embodied these principles.

Flight Safety

A. Howard Hasbrook, director of Aviation Crash Injury Research, Cornell University set forth design requirements aimed at giving occupants of passenger transports the best chance of surviving crashes (AW Nov. 5, p. 61). He recommended design consideration of the point at which the wings separate from the fuselage in a crash. When the wing center section is ripped from the fuselage it destroys the ability of nearest part of the cabin to remain intact. Separation outboard leaves the cabin whole but should not occur in a fuel storage area because of the increased danger of fire. In high wing aircraft the wing should be designed to separate before impact load exceeds the fuselage yield point. When this is done, the forward end of the fuselage need not collapse to dissipate the inertia of the wing and engines. Hasbrook emphasized that humans can survive greater decelerations than current aircraft.

Meteorology

A joint session of IAS and the American Meteorological Society heard Roy M. Endlich of Geophysics Research Directorate, Air Force Cambridge Research Center, describe a cross-sectional model of the jet stream used to extrapolate the position of a jet stream core from incomplete observations. The model can be a useful aid to forecasting and further research.

Most important feature of the model is a jet stream front curving downward and to the south from the core. The front does not reach the ground and is not part of the surface front usually associated with a jet stream. The jet stream front can be used by pilots to locate the core for navigational purposes. A "step technique" (AW April 2, 1956, p. 41) is used which allows the pilot to climb to the core along the frontal surface which can be identified by a temperature gradient within the surface rising steeply (2 deg. C per 30 miles) from north to south.

Another important feature of the model is the location of two cells of turbulence, one to the north and the other to the south of the stream. The one to the north is the more intense and occurs at a lower altitude. The one to the south occurs at about the same altitude as the core of the stream. Endlich said the model is being continuously modified.

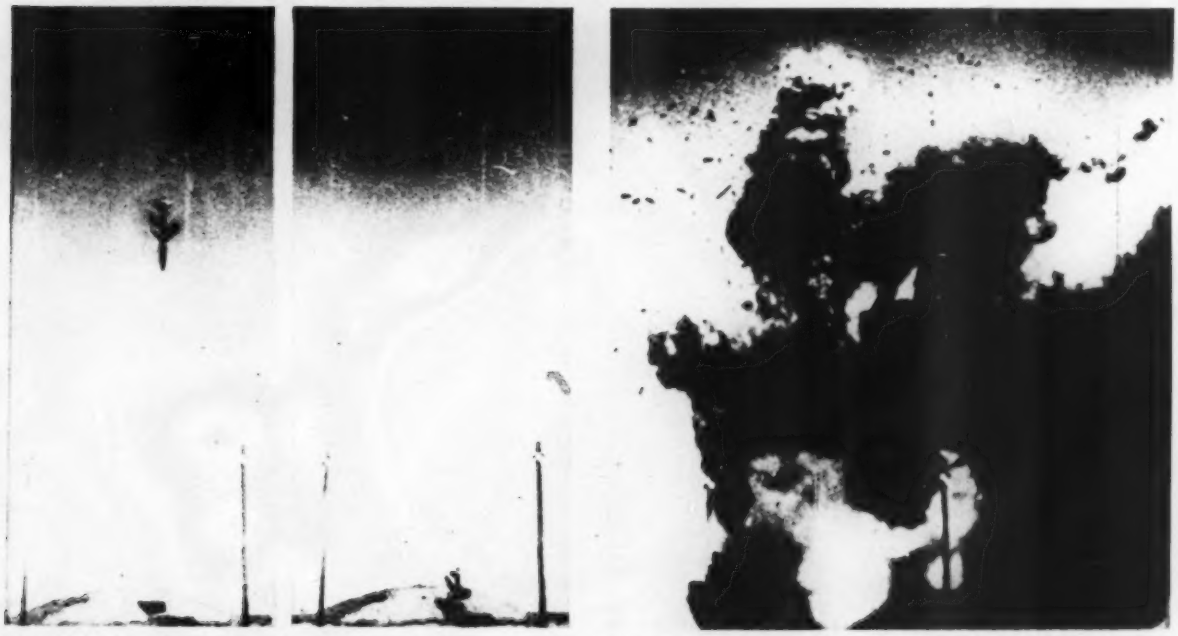
Joachim P. Kuettner, also of AFCRC, reported on his mountain wave studies. He reported evidence of a connection between mountain waves and jet streams but said that its precise nature is not yet clear.

While the most intense mountain wave turbulence exists at or below the altitude of the crest of the mountain, Kuettner said that pilots should be advised to hold at least 1.5 times the altitude of the mountain crest when crossing an area in which standing waves are predicted. He pointed out that while the initial downdraft in the lee of the mountain disappears with altitude, the updraft generated by adiabatic heating persists at altitudes up to and above the tropopause.

He said that the violent turbulence near the rotor cloud at low altitude occurs in such small areas that there is a danger that pilots will ignore forecasts believing them to be wrong. He showed movies of a Pratt-Read glider sailing in still air two minutes before it disintegrated in the turbulence of the rotor. The sailplane was stressed for 10.5 G. Kuettner estimated the gust loads it encountered at 15-20 G.

FIRST pictures of new Lacrosse guided field artillery missile which is being produced for Army by Glenn L. Martin. Prime development contractor was Cornell Aeronautical Laboratory (AW Sept. 17, 1956, p. 27). Army is training Marine Corps Lacrosse batteries.

Army's Lacrosse Used as Field Artillery



LACROSSE plunges at target bunker in steep trajectory. All weather guidance does not require observation of missile in flight. Solid propellant rocket and simple truckbed launcher ease field operation so missile can answer call for fire as quickly as 105mm. howitzer. Size of missile indicates it could carry tactical nuclear warhead. Configuration was first shown in Aviation Week artist's drawing.

Symington Report Urges Airpower Boost

By Katherine Johnsen

Washington—All segments of the Eisenhower Administration's Air Force program were termed inadequate in the face of the Soviet threat last week by the Democratic majority of a special Senate Air Force Subcommittee headed by Sen. Stuart Symington (D.-Mo.).

These findings in the subcommittee's final report were based on extensive hearings held last spring and summer. They were challenged down the line in a Republican minority rebuttal.

Democratic subcommittee members, in addition to Sen. Symington, were Senators Henry Jackson (Wash.) and Sen. Sam Ervin (N. C.).

The Republican members were Sen. Leverett Saltonstall (Mass.) and former Sen. James Duff (Pa.), who was defeated last November.

The majority made no specific recommendations but urged that the deficiencies "be corrected as promptly as possible."

The Democrats protested that U. S. military airpower has been weakened because of the government's "failure to act on national intelligence information, and also because of a tendency to either ignore or underestimate Soviet military progress."

Financial considerations, the majority report objected, "have often been placed ahead of defense requirements to the serious damage of our airpower strength relative to that of Russia, and hence to our national security."

For "special attention," the report singled out "the importance of taking prompt steps to see that the American people are given more of the truth about the relative strength of the U. S. as against that of the Communists. . . .

"Under our form of government, the American people have not only the right, but also the need, to receive all information about our national defense which would not help a possible enemy. Nevertheless the public is neither adequately nor accurately informed about our military strength as against the great and growing military strength of the Communists.

"The public," it added, "has failed to receive from official sources complete, accurate and timely information which it has the right to know."

The minority report claimed that the majority report takes an unduly pessimistic view of the state of our defense today and of our planning for the future. It said, in part:

"Our defense establishment can never be in a state of perfection because military forces in being at any one time can always be improved by new weapons and equipment which scientific progress is continually making possible."

The different approaches taken by the two reports resulted in these divergent conclusions from the same body of testimony:

• **Majority relied almost entirely** upon the testimony of USAF commanders, placing relatively little weight upon the testimony of the civilian secretaries.

The majority indicated its lack of confidence in the civilian management with this comment:

"With proper programming and administration in the Department of Defense, it would be possible to maintain air supremacy over the Soviets without jeopardizing a sound economy and without imposing additional tax burdens upon the people."

The minority objected that "the failure to give sufficient weight to the testimony of the civilian heads of the Department of Defense . . . runs counter to the constitutional principle of civilian control over the military forces. . . ." It also relied heavily upon the testimony of the civilian chiefs—including USAF Secretary Donald Quarles—and singled out the optimistic segments of the reports of USAF commanders to support its position.

• **The majority compares** USAF airpower with Soviet airpower, largely dismissing offensive naval airpower. Its report says "the decline in the strategic striking power of our Air Force as against that of the Soviet cannot be overcome significantly by the use of naval airpower."

The minority report emphasized the importance of naval airpower and argued that, in any comparison on airpower, the total strength of the Free World bloc should be weighed against the total strength of the Communist complex. It accepts the testimony of Defense Secretary Charles Wilson that "the U. S. and its allies together have more modern jet aircraft and are producing more modern jet aircraft than the combined Communist bloc."

• **In placing blame and credit,** the majority and minority observations both have a political tinge.

The majority declares that the strong USAF striking force now in being should not be credited to the Eisenhower Administration. The striking force, its report said, "is due in large measure to weapons designed, money appropriated and contracts let many years ago."

The minority objected that the majority report "confines its analysis almost exclusively to the four years since 1953. It is obvious, however, that our capacity for defense cannot be analyzed simply in terms of the last four years. . . . The forces that we had at the close of World War II; the sharp cutback in all defense spending that followed; the buildup for the war in Korea—all these were factors in the defense status inherited by the new administration in 1953."

On one major point the majority and minority are in agreement: the need for prompt action to remedy the shortages of technical manpower.

Majority findings, with the minority comments, included:

"The testimony is that the Russian long-range air force has in operational units more long-range jet bombers (B-52 class) with a nuclear bombing capability than has the U. S., and also that Russia is producing more bombers of that character than the U. S."

The majority noted that a request by USAF Chief of Staff Gen. Nathan Twining for six additional B-52 wings has not been approved.

Listing the "principal factors which limit our strategic airpower" as lack of technical personnel, modern jet tankers and long-range jet bombers and bases, the majority said that "the testimony is that, provided adequate funds were expended, these limitations could be removed and our present estimated strategic air superiority maintained over the Russian."

The minority objected that "nowhere does the majority give proper consideration to the extensive testimony received on the significance to our strategic airpower of the B-47 bomber and overseas base structure." Its report quotes Gen. Twining's conclusion that the B-47 force, "coupled with a reasonable B-52 force, presents the Soviet air defense commander with a problem almost impossible to solve."

The majority report declared that "the testimony is that at the present time our air defense system is inadequate, primarily because most of our fighter planes in operation are not capable of attaining sufficient altitude to attack successfully modern Russian bombers and because our radar warning network is inadequate."

The minority, on the other hand, pointed to the testimony of Gen. Earle Partridge, commander of Air Defense Command, that the fighter altitude deficiency "stems back to a lack of research and development in the years long since past," and that "the effectiveness of our air defense is increasing by leaps and bounds by the introduction of SAGE equipment" and other steps.

Symington Report on Airpower

Following are the conclusions drafted by the Democratic Majority of the Senate Armed Services Subcommittee on the status of U. S. airpower:

(1) In any future war there will be far less time than ever before, in which to mobilize. As a result the importance of "forces in being" has steadily increased to the point where they are now indispensable.

(2) The U. S. has a strong strategic striking force at this time. This is due in large measure, however, to weapons designed, money appropriated and contracts let many years ago; and even this strength is declining relatively as against the steadily growing striking capacity of the Soviets.

(3) The defenses of the U. S. have been weakened because of the failure to act on national intelligence information, and also because of a tendency to either ignore or underestimate Soviet military progress.

(4) The Soviets exceed the U. S. in the number of modern combat aircraft in operational units. They are currently producing more combat aircraft than the U. S. They have decreased the time used between the original design and quantity production of combat aircraft as compared with the U. S.

(5) We now have an insufficient number of long-range modern jet bombers, and there is no program to produce (enough).

(6) The growing shortage of skilled manpower is resulting in inadequate maintenance of aircraft. . . .

(7) The U. S. has the capacity to produce an adequate number of jet tankers, but has failed completely to do so. . . .

(8) The decline in the strategic striking power of our Air Force as against that of the Soviet cannot be overcome significantly by the use of naval airpower.

(9) The effectiveness of our strategic striking power, and also of our air defense, is dependent in large measure on an adequate base structure at home and abroad. The U. S. has an insufficient airbase structure. . . .

This deficiency in the continental U. S. is becoming increasingly dangerous because of the current deterioration in our overseas base structure, along with the growing long-range capability of Soviet aircraft.

(10) Inadequate housing and inadequate pay scales are decreasing the effectiveness and morale of our Armed Forces.

(11) The vulnerability of the U. S. to sudden attack has increased greatly during the past decade, and this vulnerability will continue to increase in the foreseeable future.

(12) The Department of Defense has failed to develop an adequate defense warning system.

(13) The direction and planning of naval strength again leaves the U. S. vulnerable to submarine attack . . . and particularly vulnerable to submarine missile attack on military and civilian targets within our heartland.

(14) The Soviets are rapidly closing the qualitative gap. Yet, our qualitative lead is now being given as justification for our having passed over to the Soviets quantitative superiority.

(15) The duplicating approach characteristic of many research and development programs in the Department of Defense, along with the dollar limitations established for such programs, has retarded needed modernization of weapons systems.

These policies have retarded important scientific breakthroughs. They contrast with the Soviet policies which have produced extraordinary Soviet progress in the research and development fields.

(16) The Soviets exceed the U. S. in rate of technological development, in training facilities, in speed and quantity of prototype development and training of scientists and engineers.

(17) The Department of Defense has permitted duplication, even triplication, among the three services in the development and production of missiles; and has permitted comparable waste in allocation to the three services of responsibility in missiles.

The Department of Defense also delayed in giving overriding priority to the ballistic-missile program. As a result, there has been a serious loss of time as compared with Soviet progress.

(18) Confusion and therefore inefficiency in defense planning have developed from the vacillating policies of first emphasis then de-emphasis with respect to limited war as against unlimited war. It is essential that we be prepared for both.

(19) The U. S. has insufficient airlift capacity to maintain the mobility of the Army and enable it to meet overseas commitments; nor do plans include provisions for adequate airlift.

(20) Financial considerations have been placed ahead of defense requirements to the serious damage of our airpower. . . .

(21) The U. S. has the capacity to produce and maintain airpower which is relatively stronger than that of the Soviets, but the Department of Defense has not utilized this capacity.

(22) With proper programming and administration in the Department of Defense, it would be possible to maintain air supremacy over the Soviets without jeopardizing a sound economy and without imposing additional tax burdens. . . .

(23) Under our form of government, the American people have not only the right, but also the need, to receive all information about our national defense which would not help a possible enemy. Nevertheless, the public is neither adequately nor accurately informed about our military strength as against the great and growing military strength of the Communists. . . .

Saltonstall Rebuttal

Sen. Leverett Saltonstall (R.-Mass.) declined to sign the majority report on U. S. airpower. These are his conclusions:

1. The majority report takes an unduly pessimistic view of the state of our defense today and of our future planning.

2. It is not sufficiently objective, because it does not take into account all testimony pertinent to the points covered.

3. It does not give sufficient weight to the testimony of the civilian heads of the Department of Defense. . . .

4. It confines its analysis almost exclusively to the four years since 1953. In my judgment, the present military effort cannot properly be evaluated without considering our position at the close of World War II, the speedy demobilization after that war, and the buildup for the Korean war, which determined the composition and capabilities of our defense forces in 1953.

5. Our airpower and our naval strength, together with our ground forces, make us superior to the Soviet Union today.

That is the opinion of those who testified. . . .

We can never engage in a numbers race with Russia. We do not want to do so. What we do want are balanced land, sea and air forces which give a visible deterrent and such power to retaliate quickly and devastatingly that no enemy dare attack.

6. Our Defense Establishment can never be in a state of perfection because military forces in being at any one time can always be improved by new weapons and equipment which scientific progress is continually making possible.

The task then is to press forward with those programs which, in our judgment, will provide for such modernization of our forces as is essential for the security needs of our country.

Vast programs to this end are now in progress. We can be optimistic about them and take confidence from the many instances of solid accomplishment.

In my judgment, there are no quick and easy solutions to those problems already identified. They require continued unrelenting efforts by the Department of Defense. . . .

Wilson Stands Firm on Budget

Washington—Secretary of Defense Charles E. Wilson told members of the House Armed Services Committee last week that the cost of the defense program "will continue to creep up" indefinitely—probably between $1 and $2 billion annually—despite administration efforts to hold the line on the budget.

In his first appearance before the new Congress, Wilson said higher costs for missiles and other complex hardware will more than offset any savings from manpower reductions.

The Defense Secretary told the committee that "the changes in manpower because of guided missiles and other advanced equipment will be slow, probably not more than 5%, plus or minus, in any year."

Wilson firmly opposed any reduction or increase in Fiscal 1958 budget requests and said the administration's program would provide "a high level of military preparedness for the long-haul."

Noting that the original estimates of the military services totaled $48.5 billion—as compared with the $38.5 billion ultimately provided in the Fiscal 1958 budget—Wilson told the committee:

"It should be obvious that a sudden increase of our military budget by one-third to anything in the order of $48.5 billion would be unreasonable and misunderstood all over the world. If it were to be done at this time, it would require the imposition of some types of controls on the economy, and, in addition, it would represent a major move toward mobilization."

Manpower Reduction

With reference to a proposal contained in a Defense Department staff study last fall that the 1958 budget provide for an 800,000 manpower cut, Wilson said:

"On the other hand, the sudden reduction in the number of military personnel by 800,000 is not justified considering the present international situation.

"Such a reduction would require important changes in overseas deployments and, in the absence of sound disarmament agreements, would have an impact abroad which the Free World could ill afford at this time."

In addition to Wilson, who was accompanied by Adm. Arthur Radford, chairman of the Joint Chiefs of Staff, the committee was briefed by Navy Secretary Charles Thomas and Adm. Arleigh Burke, chief of Naval Operations; Gen. Randolph Pate, commandant of the Marine Corps; Secretary of the Army Wilber Brucker, and Gen. Maxwell Taylor, Army chief of staff.

All the witnesses firmly supported the Fiscal 1958 programs for their services, although they reflected reductions in their original estimates. The Navy's original request of $11.9 billion was reduced to $10.9 billion; the Army's original request of $11.3 billion, to $9.7 billion.

P6M 'Within the Year'

Adm. Burke said the Navy expects to place prototype P6M SeaMaster attack seaplanes in operational development status "within the year." The crash of two prototypes of the P6M (AW Nov. 19, p. 34) has not affected the Navy's plans to buy six prototype and 24 production models of the four-engine jet seaplane.

Brucker said that, by mid-1958, approximately 70% of the antiaircraft battalions assigned to the Continental Air Defense will be Nike missile battalions.

Thor Destroyed in Flight Test Launching

Washington—Douglas Thor, intermediate range ballistic missile, misfired on its first attempted launching at the USAF Missile Test Center, Cape Canaveral, Fla., on Jan. 19.

The prototype Thor, which is the first full-scale IRBM to reach the flight test stage, burned to destruction in the air shortly after leaving the launching pad at Cape Canaveral. No personnel were injured during the misfire. Fire was believed to have been caused by failure of a minor component.

Some concern is evident over this component failure by other ballistic missile contractors since the same item also is used on the Convair Atlas and Martin Titan, intercontinental ballistic missiles. Atlas prototype is also at USAF Missile Test Center being readied for experimental flight testing.

Douglas Thor is the first ballistic missile designed for ranges over 1,000 miles to reach the flight test stage. Army's earlier 3,000 mile test flight from Cape Canaveral was with a three stage Jupiter test vehicle using a Redstone missile as the first stage, followed by a cluster of Sergeant rockets as the second stage to boost a single Sergeant on the final stage.

Neither the Army's Jupiter nor the Navy's Polaris IRBM projects have yet reached the flight test stage as completed missiles, although research type test vehicles such as the Redstone-Sergeant combination and the Lockheed X-17 have been fired to obtain development data for these as well as various other USAF ballistic missile projects.

Defense Department would make no official comment on the Thor misfire on the grounds that any statement "would reveal the status of the program." Russian test firings of ballistic missiles over 1,000 mile range have been detected for more than 18 months with a frequency of five firings a month evident during the past six months (AW Dec. 5, p. 21).

Vanguard Program Nearly on Schedule

New York—Procurement for the Vanguard earth satellite program is on schedule with one or two exceptions, Richard W. Porter, chairman of the Technical Panel on the Earth Satellite Program, told the Institute of the Aeronautical Sciences.

Porter listed these specific milestones in the Vanguard program: tooling for the first stage structure is complete, and several complete structures have been built by the Martin Company. Several first-stage General Electric rocket engines have passed qualification tests, but one engine failed to pass and an intensive program is underway to discover the reason.

All parts of the guidance and control system are in bench and system test at Martin. Aerojet has found solutions for the critical problems affecting second-stage pressurized rocket design. It appears that both contractors for the solid-propellant third stage—Grand Central Rocket and Allegany Ballistic Laboratory—will have satisfactory designs in time; both are currently conducting firing tests.

Hunter Cutback Forces Layoffs

London—Cancellation of orders for Hunter fighters is forcing Hawker Aircraft to consider closing two of its factories.

Hawker says "heavy progressive redundancy" can be expected among the 4,000 workers at its Blackpool plant due to the cutback. The first layoff will begin this week. The Blackpool plant, the biggest single aircraft production unit in Europe, may close completely.

Remaining production will be diverted to the Hawker plant at Kingston-on-Thames. Following cancellation of government orders for 100 Hunters, the company said it would close its plant at Langley, laying off 700 workers.

The prospect of 4,000 unemployed was described as a "disaster for Blackpool."

The area already has the highest unemployment rate in Northwest England.

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Defense Group Drafts New Salary Plan

By Claude Witze

Washington—Department of Defense will be advised this month that its military pay practices are a "major impediment to national security."

The suggested remedies, to be sought later this year in congressional legislation, will have a profound effect upon the aircraft and avionics industries.

Over a period of years, the modernized military pay system is expected to alter radically the skilled manpower supply situation, reduce Army, Navy and Air Force requirements for operational hardware and curb the trend toward more contract technical services.

Recommendations for a revised pay system by the Defense Advisory Committee on Professional and Technical Compensation will be presented to Defense Secretary Charles E. Wilson soon. They include:

- **Higher pay scales** to improve the military standard of living.
- **Pay incentives to reward** skilled contributions to combat capability. This would abolish across-the-board pay scales which give equal reward to two people of the same seniority and service regardless of the type and amount of work they do.
- **Pay incentives to encourage** meritorious performance as opposed to survival for a long period of time in uniform. These incentives will encourage men to seek military jobs of increasing difficulty and responsibility.
- **A broad pricing base** for identification of a variety of skills. The system must provide rewards in the technological fields, where highly skilled technicians are most vital to combat capability, and not encourage excess personnel in fields that already are overcrowded.
- **Pay levels close** to those paid outside the armed forces for same skills.

The Defense Department will draft legislation to be offered in Congress.

Headed by Ralph J. Cordiner, president of General Electric Co., the committee says bluntly that the military personnel problem at the working level is "not a matter of the total number of people on hand, but it is a matter of the level of competence."

Major problem for the military, the committee says, is that it cannot "keep and challenge and develop" skilled personnel long enough for them to make a real contribution.

Military units operating aircraft and avionic equipment are fighting a running battle to keep their modern and complex weapon systems in operation.

A year ago, the first operational North American F-100 fighters were seriously handicapped by the lack of sufficient trained technicians (AW Dec. 19, 1955, p. 14).

For all modern weapon systems, USAF has been forced to use an increasing proportion of contractor technical services, in some cases turning over the entire maintenance of ground systems to private corporations.

The Cordiner Committee study on military pay recognizes these facts. It says, in effect, that the Defense Department is foolish to continue buying expensive and complex weapon systems without guaranteeing that it will get maximum utilization by providing proper personnel to maintain them.

"Excellent military machinery now [in hand is not always being fully utilized or maintained," the study says, "because the men assigned have not had enough training to understand it or even how to operate and maintain it.

"The solution here, of course, is not to draft more men to stand and look helplessly at the machinery.

"The solution is to give the men already in the armed forces the incentives required to make them want to stay in the services long enough and try hard enough to take on these higher responsibilities."

The Cordiner Committee study found that 44% of the nation's entire military force is engaged in technical jobs. During the Korean war, the figure was 41%, already up sharply from the 34% figure at the end of World War II.

In the military, technical ratings are classified to cover personnel engaged in electronics, mechanics, repairs and "other technical." The last group includes medical and dental technicians, intelligence analysts, meteorologists, surveyors, draftsmen and photographers.

Under the present setup there are seven grades, up to E-7, master sergeant or chief petty officer. The committee will recommend that there be nine grades. The new E-8 and E-9 will include USAF line chiefs and bosses.

Promotion to these grades will not be automatic. It will be based upon a man's skill and his production to help keep the forces combat-ready. Under the present system, there are too many unskilled men with long service tenures who outrank their more important and competent brothers in uniform.

To industry, this should mean that the Army, Navy and Air Force will, in the long run, make fewer demands for personnel capable of this work, leaving more manpower for industry.

On the other hand, industry will have to pay more of its own training costs as the armed forces cut down on the availability of technicians trained in military schools.

Over a long period of years, the program also should cut down the requirement for military equipment. If combat efficiency is improved and a larger percentage of existing equipment kept combat-ready despite its growing complexity, economies are expected.

Vast reduction in military training costs also is promised under the new system. With more career soldiers in highly technical jobs, the need for schools, instructors and other training appurtenances will be cut down. Estimates on the size of this saving are now being worked out and will be sent to Congress along with the Defense Department's proposed new legislation.

LeMay on Manpower

Washington—Cordiner Committee recommendations for revision of military pay scales, if adopted by the Defense Department and authorized by Congress, may result in more economies than new expense.

Gen. Curtis E. LeMay, chief of USAF's Strategic Air Command, has made these estimates:

- **An increase in the reenlistment rate of skilled airmen from 35% to 65% would retain 10,000 additional key personnel in the current fiscal year. Their value to SAC—$148.6 million.**
- **Increased retention of young officers from 25 to 50% would keep an additional 670 of them in uniform each year. Their value to SAC—$196 million.**
- **In Fiscal 1958, it would be possible to cut recruitment from civil life by 18,000 men. Investment in these 18,000 over a four-year period—$268 million, most of which can be saved.**
- **Replacement training costs can be slashed by 46%. To SAC, in Fiscal 1956, this would have amounted to $49.1 million.**
- **Air Training Command efforts now bleed SAC of the benefits of 29% of its personnel. Closing 10% of the ATC bases would save $110 million.**
- **Improved reenlistment rate would increase combat capability and reduce the number of aborts. Estimated additional B-47 combat strength from this factor alone—six and one-half additional wings worth $2.5 billion.**

SOUTHEAST view of passenger building and control tower at London Airport Central. On the tarmac in the foreground are two BEA Viscount airliners. BEA operates 28 Viscounts in its fleet, has more on order.

BEA Stakes Future on Turboprop Fleet

Lord Douglas says Vickers aircraft appear best for economical operation on short-haul routes.

By L. L. Doty

London—British European Airways will stake its future upon an all-turboprop fleet until it finds a jet specifically designed for its medium-range route pattern.

BEA Chairman Lord Douglas of Kirtleside admits that "we are talking with British manufacturers on the possibilities of producing a jet that will meet our needs." He adds, however, that the turbojet must be "tailored" to BEA's route structure just "as our successful turboprops" have been.

"We have," he said, "great faith in the turboprop as the aircraft most likely to achieve lowest costs on short-haul routes."

Higher Profit Margin

This equipment policy stems from the economic, operational and sales successes the airline has enjoyed with its fleet of 28 Viscounts which are now producing close to 50% of total available ton-miles. The Viscount experience has prompted the company to place firm orders or take options on a total of 77 Vickers turboprops, ranging from the 58-passenger Viscount 802 to the 96-passenger Vanguard 951.

Because of its short-haul nature, BEA relies upon a steadily increasing high volume of traffic to sustain its slim margin of profit. As a consequence, the airline looks to the introduction of faster, larger turboprops as the chief means of maintaining a profitable operation through more seat-miles and lower costs per seat-mile.

At the present time, the airline operates 28 Viscounts, 19 Airspeed Ambassadors and 38 DC-3s in addition to six de Havilland Rapides, two Herons and eight DC-3 convertible passenger-freighters.

During the early part of the year, flight frequency of the relatively small fleet was intensified in order to meet growing traffic demands, but on-time service suffered as a result, testifying to the need for more airplanes.

Paradoxically, BEA faced a dwindling traffic situation during the latter part of 1956 and had difficulty in filling the seats offered despite the equipment shortage.

The decline in business is attributed to England's stringent economic policy and the unsettled condition in the Mediterranean area, popular tourist retreat. Profits are further threatened by the depreciation of route development costs.

The airline hopes to offset such temporary reversals through stepped-up advertising and promotional campaigns, the first of which was launched early this year.

It is the first time in BEA history that a large-scale advertising program has been undertaken.

Viscount Popularity

It is the selling power of the turboprops on which BEA is pinning its hopes. The airline is convinced the Viscount 701 and its successors will lure customers from competitors to provide a reliable flow of passenger traffic.

For example, BEA officials point out that the popular Elizabethans cannot compete with the drawing power of Air France's Viscounts on the Paris-London route.

They say that only the introduction of the Viscount 802s on the route next month will restore BEA's strong position in this market.

Principal factors contributing to the popularity of the Viscounts with BEA officials are its money-earning capacity and its economy of operation.

Viscount Earning Power

Here are a few highlights of BEA's experience with the Viscount 701:

• **Viscounts earned a profit** for BEA of $3,188,000 in Fiscal 1956 at a break-even load factor of 54%. During the year, the turboprop fleet carried 617,000 passengers 522.4 million pas-

senger-miles at an average load factor of 67% to gross $27 million. (BEA's Viscounts have a 47-passenger configuration. Trans-Canada Air Lines recently converted its Viscounts to 40-seats, while Capital Airlines uses the 44-passenger configuration.)

• **Engine overhaul time** on the Rolls-Royce Dart engines is now 1,050 hours. Maintenance check number four was increased last year to 1,500 hours from 1,200 hours. Although there was a 7.2% increase in flying hours during Fiscal 1956, engine overhauls were reduced by 35% and maintenance checks by 15% on all aircraft operated by the airline.

• **Utilization has reached as high** as six and three-quarter hours. During Fiscal 1956, the total utilization rate was 2,217 hours, a 29% increase over the previous year. Viscount revenue flying hours are now approximately the same as those of the Elizabethan.

• **Average cost per seat-mile** is about 4½ cents on an average route distance of 466 miles.

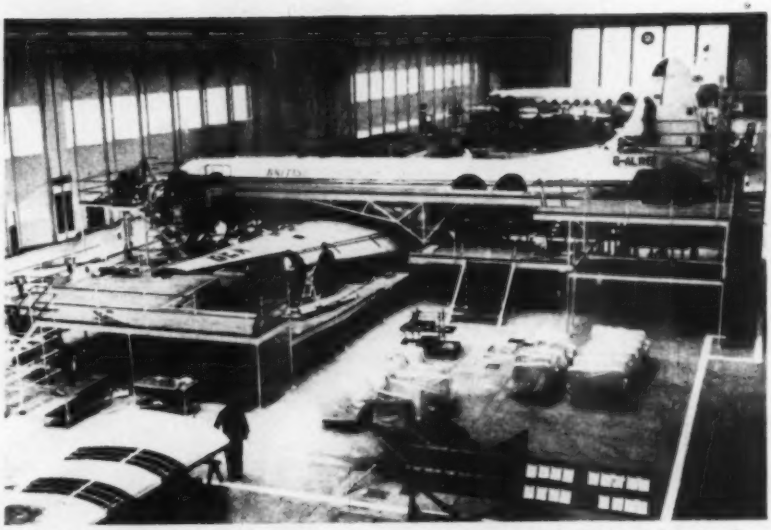
• **During Fiscal 1956,** the Viscount fleet flew 10 million aircraft-miles in 46,800 hours and produced 59 million capacity ton-miles.

Traffic Estimates

The airline's long-range equipment program is based upon an estimate that forecasts a traffic volume in five years that is double the 1956 amount.

A total of 38 Viscounts in the 800 series is on order, and delivery was to have begun last summer. Delivery was delayed, however, due to a switch from the 801 to the 802, and the first of the 24 Viscount 802s was received last month. The balance is scheduled for delivery by the end of the year.

The London-Paris route will be served exclusively by the Vickers 802s. Later, it will replace the Viscount 701 on routes to Amsterdam, Geneva and



ONE OF BEA'S Viscounts shown undergoing maintenance at the BEA engineering base dock at London Airport.

AERIAL view of BEA engineering base at London Airport. Modern engineering facilities have cut the cost of operation.

BEA VISCOUNT 701 passes the company engineering base at London Airport as it comes in to land. BEA's Viscount fleet flew 10 million aircraft-miles in 46,800 hours and produced 59 million capacity ton-miles.

Frankfurt, and the Elizabethan on routes serving Brussels, Dusseldorf, Nice, Hamburg and Berlin. The move is expected to counteract some of the competition created by West Germany's growing Deutsche Lufthansa.

Later in the year, delivery of the 14 faster Viscount 806s powered by the improved Rolls-Royce Dart R. Da.7 engines will begin. Service with the Vickers Vanguard is scheduled for 1960.

The airline holds options on seven Viscount 810s and 12 Viscounts 840s. Both types are expected to be available for delivery in 1958 and 1959 if the options are taken up.

Experiments with helicopter operations by BEA have not been too successful. Failures thus far have been attributed to lack of experience and inadequate equipment from an economic standpoint.

Six helicopters make up the BEA fleet—two Bristol 171s, one Bell 47B and three Westland WS-55s. During Fiscal 1956, BEA accumulated 1,555 hours with its helicopter fleet.

Last year, test flights with the prototype Bristol 173 twin turbine-engine helicopter were conducted, and basic plans were made for a program of route development flying. The airline hopes to expand this program with variations of the Bristol 173 this year and next.

Helicopter flights conducted during Fiscal 1956 carried only cargo and mail. Passenger service will not begin for at least another year. The two Bristol 171s operated 63 revenue flying hours during the year, and the three WS-55s flew 469 revenue hours.

Capacity ton-miles offered totaled 12,986. Of this, 4,524 ton-miles were sold. A total of 1,910 flights were operated with a regularity record of 81%. Miles flown totaled 31,597 at a block-to-block speed of 59 mph.

BEA admits that Sabena holds a strong lead in scheduled helicopter service in Europe (AW Jan. 28, p. 37) and feels that it must intensify its development program if it is to keep pace with Sabena and participate in the huge inter-city helicopter market visualized by mid-1960.

Whether BEA will find funds to underwrite such a prodigious program is questionable. Its short-haul route structure requires rigid control of expenditures in every phase of operation. A decline of traffic increases in calendar 1956 has forced the airline to review its costs and brought a warning from Lord Douglas that "the profit margin between revenue and expenditure is still a small percentage of our total costs and could be eliminated by any substantial rise in costs or fall-off in revenue." He added:

"We may well find that we shall not reach our revenue target for the current financial year."

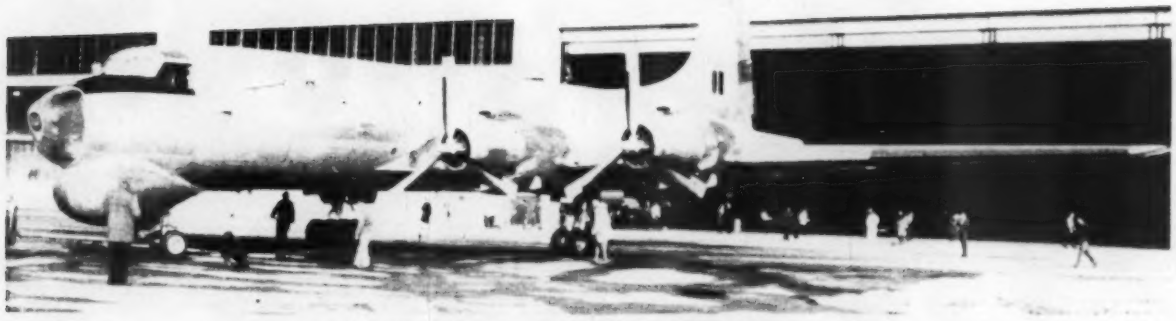
During fiscal year 1956, operating costs jumped 24% over the previous year. This was accompanied by a 25% increase in total revenues and an 18% increase in passengers carried.

The airline now employs approximately 9,600 persons, a 5% increase in total personnel over the previous year. Although wages increased by 14% in Fiscal 1956, cost of wages and salaries per unit of production dropped 10%.

BEA's maintenance base is located at London Airport, and the reduced cost of operation per man hour is attributed to these modern facilities.

Latest Convair 880, Airport Details

Latest Convair artist's conception of what the 880 will look like (above) shows more sharply tapered vertical fin, extended dorsal and more nose forward of the windshield than earlier versions. Redesigned cockpit windows give better visibility downward and aft. More passenger windows apparently presage greater capacity. Model of Convair 880 at airport passenger loading gate (left) is used by company engineers to study handling techniques as they will concern airline operators and airport managers. The three-dimensional scale model airport layout includes fuel trucks, power carts, towing vehicles, baggage trains, in-flight food truck and elevator, portable jet deflection fences, passengers, flight and ground crews, a terminal building, and a model of the 615 mph. Convair jet transport.



Canadair CL-28 Rolls Out

Canadair Ltd., subsidiary of General Dynamics Corp., rolled out its CL-28 maritime reconnaissance version of the Bristol Britannia transport. CL-28 uses Wright turbo-compound engines in place of turboprop engines of Britannia, and includes fuselage modifications for chin radome, and for MAD anti-sub gear in tail. Because of bomb bay installation, full monocoque construction of Britannia was abandoned. First flight of CL-28 is expected in April. Second aircraft is coming off the line as static tests are carried out on first aircraft.

Burgess Aims First at TWA Management

By Glenn Garrison

New York—Improved managerial judgment in solving Trans World Airlines' problems is the primary goal of new TWA President Carter L. Burgess. Getting managers in the field to recognize their responsibilities will be his main objective for the next 60 days, according to Burgess, who went to work in his new job last Monday.

The carrier's problems recently have reflected themselves in poor financial results. In November 1956, TWA lost $2.29 million in its domestic, $1.25 million in its international operations (AW Jan. 7, p. 47).

Biggest of the problems may be inefficient utilization of the airline's planes, Burgess told AVIATION WEEK. Two other major targets for improvement are maintenance costs and a balanced level of personnel.

Personnel Cuts

As much as 10% of TWA's personnel force may be released at least temporarily to bring strength more in line with the operating picture, Burgess said.

He cited increases in personnel during 1956, a bad year for the airline, as a factor in the present imbalance of employe strength.

Earlier last month, Burgess told 68 TWA officers, department heads and regional directors at a weekend session in New York that decentralization of authority would be a cornerstone of his organizational plans for the airline. He was proceeding, the new president said, on two major assumptions: that TWA had not been doing well, and that TWA "had better do something about it now."

In creating a "new look" for the airline, Burgess told the officials they should seek better dependability of service, more attentive passenger handling, more efficient scheduling, greater operational economy and more ingenious merchandising.

Burgess is striving particularly for better judgment in the field with more decisions made by managers and less referral back to higher authority.

The aviation business has departmentalized functions, he pointed out, so a maximum number of decisions should be made within the units.

Otherwise, the TWA official said, decisions bog down in the "giraffe's neck" of communications from the field to central authority and back.

Burgess is setting up an operations and briefing room in New York to serve as a "mirror of operations" over the entire system. He or other top managerial people will be able to spot check the functioning of the system at any time of day or night in the center and take immediate action where necessary.

The new president sees a need for considerable work in getting more flexible use from TWA's aircraft. Part of the need is for better scheduling of flights in relation to seasonal traffic situations. This would involve shifting schedules to correspond with the directional flows of traffic. Along with this, improved merchandising would help fill seats on the lighter schedules.

TWA's maintenance problems have included difficulties in keeping engine pipelines filled, Burgess said. This situation recently has improved, he added.

The airline's present equipment situation, as good, Burgess said. The Super Constellation has proved itself an attractive airplane to the public, although he has not studied the economics of its operation. It was a little early, the new president pointed out, for him to discuss future TWA equipment such as the Boeing 707 and Convair 880 jets.

Tomorrow's Demands

But an airline as big as TWA had "better be thinking about tomorrow as well as today," Burgess commented. He referred to TWA's new department of planning and coordination, set up last August under Vice President John L. Weller, as a necessary instrument in handling long-range development. It would have been desirable for the airline to have had such a department even sooner, Burgess noted.

The resignation last month of John A. Collings as executive vice president was not related to the planned organization changes in the airline, Burgess said. Collings will render important service in his continuing membership on TWA's board of directors and as senior consultant to the board and to the president.

While Collings will devote much of his consultant service to problems of jet operations, he will not hold overall responsibility for jet planning. TWA has set up no single unit for this work, as some other major airlines have.

Burgess told his officials last month that "I would rather be president of the best airline in the business than to be known as the best president in the business, but heading a second-rate airline."

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TRANS WORLD AIRLINES

Supersonic Airliner Undertaken By Major British Aircraft Firms

London—Supersonic airliner capable of crossing the North Atlantic in approximately four hours is under consideration by a consortium of Britain's major aircraft firms.

A research project on the airliner already is under way in collaboration with the national airlines and government establishments. Firms included in the project are Bristol Aeroplane Co., de Havilland Aircraft, Vickers-Armstrong, Rolls-Royce, A. V. Roe, Short Brothers and Harland, and Handley Page.

Often Discussed

Ever since Britain lost its lead in the jet airliner market following the crashes of the de Havilland Comet, the industry has been talking about jumping to a supersonic airliner, conceding the current big-jet market to Douglas and Boeing.

Although this is the first official announcement of such a project on either side of the Atlantic, U. S. aircraft manufacturers also have plans for such airliners.

Hall Hibbard, Lockheed Aircraft vice president, stated well over a year ago that his firm considered a Mach 2 airliner well within the current state of the art.

Lockheed holds a U.S. Air Force design contract for an advanced tanker/transport, presumably supersonic, which was awarded at the time that the KC-135 jet tanker went to Boeing. The immense research and expenditure of money required for development of a supersonic jet liner is considered beyond the capacity of any single firm in the British aircraft industry. Therefore, it will be undertaken as a joint venture with considerable government assistance.

Bare Announcement

The official announcement from the Ministry of Supply did not disclose any details of the project.

Discussions on the cooperative project have been going on for about six months between the government and top officials of the seven firms.

Much of the experience in designing such an aircraft would come from the supersonic bomber project now under way at Avro. Sir Arnold Hall, technical director of the Hawker Siddeley group which includes Avro, said last December that Mach numbers in the region of 1.8 or 2 would avoid many of the temperature and structural problems of speed in the higher ranges. He said at the time that straight, swept or delta wings appeared equally suitable for such an aircraft.

Target date for the first flight of Britain's supersonic project probably would be about 1965.

It is considered likely that after preliminary details are settled, one firm may be asked to design and build a prototype with assistance from the others in the consortium.

Until that time, all the aircraft firms and the Royal Aircraft Establishment at Farnborough would contribute to the basic research and planning with advice from the national airlines—British Overseas Airways Corp. and British European Airways.

Presumably the British firms would also survey other airlines of the world for their requirements.

Airfield Loss Irks British Committee

London—Select Committee of Parliament has criticized the Minister of Transport and Civil Aviation for mounting losses by Britain's airfields despite increases in traffic.

In a report, the House of Commons committee estimates that during the fiscal year ending March 31, 1956, the country's airfields incurred a deficit of $5,196,000.

The figure is $530,000 above the previous fiscal year and according to the committee represents a subsidy of about $1.12 per passenger.

In the same period, passenger traffic jumped by 18% and freight by about 39%.

Pointing a finger at Harold Watkinson, the committee says the bigger loss, "makes it even more incomprehensible that the minister has not been prepared to take more energetic measures to increase revenue."

It continues:

"Indeed, indeed, it seems doubtful whether the minister has taken any measures to end this at all.

"In fact, the operation of the airfields is either so inefficient or so financially insolvent that the more traffic there is, both passengers and freight, the greater loss of accounts."

The committee earlier blistered both the Ministry of Supply and the country's manufacturers for the present system of military aircraft procurement.

The new report expresses surprise that the permanent secretary of the Transport Ministry should have informed them, "we do not try to attract traffic. . . . The object is not to make as much money as we can on the airfields, or even to make them pay."

The committee recommends a review of the question of outgoing traffic and recommends that Watkinson seek a boost in airfield fees and charges.

To continue virtually the same fees and charges as in 1948 says the 36-man group "is not fair to the taxpayer who had to meet the losses through taxation.

The continuation is in fact subsidizing air travel both by British and foreign companies to an unreasonable extent out of public funds."

It asserts that speed and comfort are important luxuries which should be paid by the air travelers themselves, not by the taxpayer at large.

Commenting on the fact that the minister "is apparently reluctant" to take adequate steps to reduce the existing losses, the committee recommends that the House of Commons Committee of Supply give urgent consideration to a vote on civil aviation.

De Havilland Shelves Jetliner

London—De Havilland DH118 jet airliner proposed for use by British Overseas Airways Corp. in 1962 will not be built.

In discussions between de Havilland and BOAC, officials of the two firms have agreed that requirements for such an airliner does not exist. De Havilland was reluctant to build an airliner for which it appeared BOAC would be the only customer.

Talks between the airline and the manufacturer are continuing with a view to development of a more advanced jetliner which de Havilland would build.

This could be a long range aircraft to serve as an interim airplane between BOAC's Boeing 707s and the supersonic airliner planned for the late 1960s, or it could be a medium jet designed for the special runway and route requirements of the airlines service to the Middle and Far East.

One industry source describes the DH118 as a strictly "political" aircraft. There is little doubt that the government told BOAC flatly that de Havilland was going to build the airliner for BOAC.

It was an unhappy situation for both the airline and the manufacturer, especially since the move drew considerable fire in Parliament.

Labor Member Frank Beswick charged in the House of Commons that it was a plan to prop up de Havilland following the Comet failures.

Traffic Control Clarification Needed Before Advent of SAGE

New York—Clearer statement of Common System air traffic control requirements must be forthcoming before it will be possible to determine whether all or portions of the SAGE air defense system can be effectively applied to the traffic control problem.

Unless future traffic control is studied as an independent problem, the result may be a common system that does not adequately satisfy either traffic control or air defense needs. This warning was sounded during the recent meeting of the Institute of the Aeronautical Sciences by David R. Israel in a paper co-authored by Dr. Herbert Sherman, both of Lincoln Laboratory which has been studying the application of SAGE to traffic control.

Many Similarities

Because of the many similarities between the information and data processing required for air defense and traffic control, Israel urged increased civil use of military radar, beacon and ground-air communication facilities. Such common use is "now technically feasible, economically desirable and operationally important," Israel told the IAS.

For example, recently developed narrow-band radar transmission techniques now make it possible to remote air defense radar data into civil traffic control centers, Sherman said, using only a pair of telephone lines. The technique is called Random Access PPI, or RAPPI for short, and it provides an accurate, high-quality scope presentation, Sherman said. Another example is the extensive air defense ground-air voice and data link communications facilities which are designed to meet the requirements of all-out combat and therefore have low utilization in peacetime.

Beacon Problems

Israel warned that the present civil air traffic control beacon faces serious problems in operating with the present military beacon system, unless the Civil Aeronautics Administration uses existing military interrogator stations instead of adding their own, as now planned.

He added "it is difficult to refrain from recommending that the military and civil groups abandon the present beacon concepts and re-think the entire problem."

A joint civil-military traffic control agency to insure operational continuity in time of war was suggested by Lt. Col. S. A. Mundell, new chief of the Air Force's Tracals (traffic control and landing systems) project. Mundell emphasized that the suggestion was a personal opinion and had not been "cleared" by the Pentagon. The agency must be closely integrated with the Air Defense Command, Mundell believes, but he admitted that he has no blueprint for how such a joint agency should be organized.

Comet III Prototype Expected to Fly Soon

London—Converted de Havilland Comet III prototype is expected to fly in about three weeks.

To convert the aircraft into a prototype for the Comet IV airliners, it has been fitted with Rolls-Royce Avon RA. 29 turbojets and its wings have been clipped and fitted with detachable wingtips to convert either to the 115 ft. span of the Comet IV or the 108 ft. span of the short-range Comet IVA.

The Comet III will be used for much of the development flying needed to meet airworthiness requirements of the Comet IV series.

British Overseas Airways Corp. has ordered 19 Comet IVs. Capital Airlines has four of this type and ten Comet IVAs on order.

In addition to wing redesign and fuselage strengthening, the Comet III now has artificial "feel" built into its power control system. The deicing system has been improved and the flight deck rearranged for greater crew comfort.

The aircraft also has been fitted with controls for the reverse-thrust braking system now under development and provision is made for engine silencing.

Delta Airlines Earns $3 Million in 1956

Atlanta—Delta Air Lines earned $2,915,871 after taxes from its 1956 operations, a 7.5% increase over 1955. Sale of flight equipment raised the 1956 total to $4,224,641, or $3.77 per share of Delta stock.

Operating revenues were up 16% to $72,343,884, the airline reports, while operating expenses soared 18% to $65,442,215.

Delta flew 1,188,996,000 revenue passenger-miles during the year, an 18% increase.

Available seat-miles increased 23% to 1,977,086,000, for a passenger load factor of 60.14% compared with 62.91% in 1955.

Unit cost of operations was reduced from 28.59 cents per available ton-mile to 27.75 cents a ton-mile in 1956.

The airline carried 2,606,945 passengers during 1956, a 12.97% increase over 1955 totals. Express was up 19% to 3,219,800 ton-miles; air mail was up 15% to 3,573,998 ton-miles; and air-freight total increased 5.6% to 7,783,880 ton-miles. Delta carried 28,864,871 lb. of freight during the year.

Curtis Asks New Look At ATC Development

New York—Presidential Aide Edward P. Curtis last week called for an "authoritative form of organization to control both research and operations" of air traffic control.

Curtis, in a speech at the 25th annual meeting of the Institute of Aeronautical Sciences here, charged that today's "complicated maze of committees which endeavor to resolve conflicts" often tend to drag out major problems to a solution that is an "unsatisfactory compromise."

He said a critical problem lies in the field of research and development of a common system and added that military services "tend to work on systems designed to take care of their own peculiar requirements, and which may or may not be compatible with what the Civil Aeronautics Administration is doing."

Curtis also called upon aircraft manufacturers to make more use of boundary layer and jet flap control techniques to improve landing and take-off characteristics. He said there has been a "tendency to design and build maximum performance aircraft on the assumption that somehow airports will be built to accommodate them."

Italian Airline Increases Order for Viscount 770s

London—Linee Aeree Italiane has increased its order for Vickers Viscounts from six to ten 770s.

Delivery of the first six Viscounts is to start in April and be completed by August of this year. The next four will be delivered in March and April of next year. The Italian order brings the total number of Viscounts sold to 361.

Britannia 312 Leaves For Cold Weather Tests

London—First of the long-range Bristol Britannia 312 airliners left for a series of cold-weather tests in Canada. Among the passengers was the managing director of Bristol Aircraft, Peter Masefield.

American Airlines test pilots Ken Herschel (*left*) and Dick Green (*right*) tell Fisher about the program of an impending flight test.

One of a series on the care taken by leading airlines to keep their planes fit for flight—and why this care has led them to select CHAMPION SPARK PLUGS. First—American Airlines and a look at . . .

C.A.V.* at Tulsa

By **HERB FISHER**

**Continuous Airworthiness Visit*

(*ADVERTISEMENT*)

HERB FISHER,
international aviation authority, veteran test pilot, and author

RECENTLY I was a much impressed visitor to the vast American Airlines Overhaul and Supply Depot at Tulsa, Oklahoma, where the world's largest airline fleet operating from a single maintenance base is kept in top flight order. Each of American's 200 planes comes to Tulsa at least six times every year—1,200 aircraft visits in 12 months—more than 1,500 engines completely rebuilt. In the shop, and outside on the flight line, nearly 4,000 skilled employees do the huge maintenance job needed to "keep 'em flying."

Tulsa has the dual functions of preventive maintenance and progressive overhaul. Both have the single objective of finding and correcting trouble before it starts, and before an airplane is "out of hours" and ineligible to carry passengers. American predicts, with amazing accuracy, the working life of almost every piece of equipment. This makes the job of the maintenance department clear, if not easy. The department sets up its schedule so that it anticipates mechanical trouble and takes preventive action before it occurs.

A good example of American's preventive maintenance is the autopilots flown on American's aircraft. Autopilot system components have a CAA authorized overhaul period of 5,000 hours. American pulls them at 2,500 hours—an admirable illustration of the lengths to which the airline will go to insure safety and reliability.

C.A.V. – Schedule for Airworthiness

Progressive overhaul is American's other maintenance must. Operating on a regular schedule, every aircraft in American's fleet visits Tulsa for its C.A.V.—Continuous Airworthiness Visit. About ten days are required per visit, during which time AA's inspectors and mechanics will perform an average of 5,400 different jobs on each aircraft, taking thousands of man-hours. Nothing is overlooked.

When a plane arrives in Tulsa for its C.A.V., inspectors are assigned to go over the entire airplane, checking its structure, functional systems, appearance, etc., using special test equipment. In ten days the plane leaves Tulsa "newer than new," but just a little more than 2,000 hours away from its next visit.

Using this technique, American has never had to take an airplane completely apart. These trips to Tulsa do the "out of hours" overhaul job progressively—and do it better.

Champions Proven on Engine Line

I was especially interested in the engine line, where every single piece of the big Pratt & Whitney and Curtiss-Wright turbo-compound power plants gets a meticulous inspection. I saw the typical overhaul for engines, running from

American Airlines technicians put rebuilt engine through its paces in test cell before running flight tests on it.

These four hangars—center of American's maintenance operation—contain 15 acres of floor space, handle 1,200 aircraft overhaul visits a year.

Transferring Champion Spark Plugs from original carton into American's engine-set box for shipment to line station. Champion's consistent high quality makes this possible without further inspection.

C.A.V. at Tulsa . . .

a special report for Champion Spark Plug Company

Top American Airlines executives at Tulsa tell Fisher of Champion's highly satisfactory performance. *Left to right:* E. O. Schroeder, Assistant Vice President, Quality Control Division; Fisher; J. B. Montgomery, Vice President, whose duties include supervision of the Tulsa base; W. C. Lawrence, Assistant Vice President, Engineering Division; and D. F. O'Donoghue, Assistant Vice President, Overhaul Division.

dismount and disassembly through cleaning, parts inspection, rework where needed, reassembly and testing.

It was during parts inspection, which includes tests on spark plugs and other engine components, that American began telling me about the splendid record of reliability, service, and economy of Champion Spark Plugs.

W. C. Lawrence, Assistant Vice President—Engineering, said that the whole area of ignition—spark plugs, magnetos and leads—has been the No. 1 cause of mechanical delays during the last 21 years. It is for this reason, he told me, that American particularly likes Champion's dependability and economy.

"American's philosophy is to search constantly for the most reliable ignition components available," said Lawrence. "We want simplicity, reliability, and ease of maintenance, and Champion has proven over the years to give it."

T. J. Harris, Director of Power Plant Engineering, stated that he admires Champion's research and development program, and their desire to define and resolve ignition and spark plug problems. He feels that Champion has made a notable contribution to American's operation.

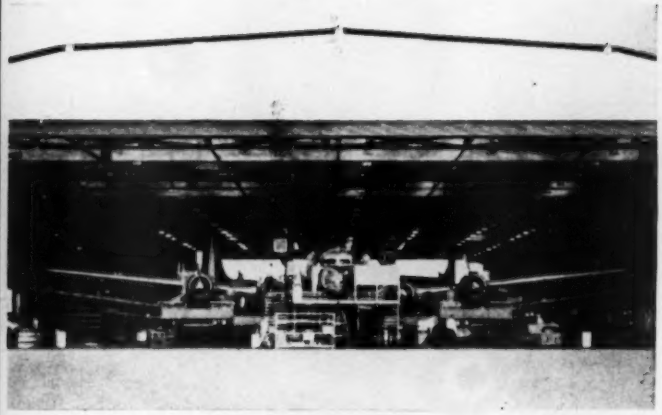
Demand Quality with Economy

E. O. Schroeder, Assistant Vice President of Quality Control Division, told me about AA's experience with Champion economy. "For years the airlines have had to concentrate on obtaining the best possible parts and accessories that would cause the least trouble. But now we are at a stage where aviation has turned into big

Champion Aviation Representative Russ Biegel monitors line service spark plug installation as part of service coverage. Technical information gained is available to all Champion users.

The engine line produces 1500 "new" engines a year. After four hours in test cells, running at all speeds, engines are flight tested by engineering test pilots for another four hours.

D. E. Tait *(left)*, Director of Supply, had favorable comments on Champion's service, economy and availability. T. B. Robertson *(center)*, Manager of Purchasing; *(right)*, T. J. Harris, Director of Power Plant Engineering.



During a C.A.V., the interior is completely disassembled, freshened, and rebuilt where needed. All structure is completely inspected and components are replaced as required. Even X-ray is used for checking critical areas.

Removing spark plugs from engine for careful testing. Rigorous inspection over the years has kept American convinced of Champion's dependability.

business. As a result, without any slacking of quality, people in the aviation field must be concerned with price as well—and Champion has been a leader in reducing spark plug prices.

"Spark plugs are a major expenditure with us, and we consider ourselves fortunate to be able to get a quality product for the lowest price consistent with reliability and performance."

10,000 Hours on Champions

Another American man that I later talked to at New York International Airport was Captain S. P. Bittner, who started flying September 14, 1924, and has accumulated 30,000 flying hours. He has been flying for American since 1929. Since Champions have been used for 10 years, Capt. Bittner has flown approximately 10,000 hours with Champion Spark Plugs, or roughly 40,000 engine hours. Capt. Bittner stated that after flying for 10 years with Champions he has never encountered true plug trouble.

The final word on Champions came from J. B. Montgomery, American Vice President—Maintenance and Engineering. "These plugs give us the high, consistent quality we need to assure long life and trouble-free operation," Montgomery declared. "We also like Champion's realistic price structure and the fine factory and field service they give us.

"Champion has built excellent spark plugs over the years for American Airlines. If they were not a quality product, they would not be on our engines."

The Champion people feel that American's experience speaks for itself in indicating to *all* pilots the superior performance and reliability of Champions.

—HERBERT O. FISHER

If you have the responsibility of selecting aircraft spark plugs, consider the fact that American Airlines . . . with millions of engine-hours experience as a guide . . . chooses CHAMPION SPARK PLUGS

Capt. S. P. Bittner, American pilot since 1929, tells Fisher he has flown 40,000 engine hours on Champions without encountering true plug trouble. Capt. Bittner flies the non-stop flight between New York and Los Angeles.

SHORTLINES

▶**National Airlines** is now using IBM equipment to process advance New York-Florida bookings, says many past-deadline and duplicated reservations are being turned up and made available to wait-list passengers. The machines check 80-90,000 cards a day.

▶**Lockheed Aircraft Corp.** sales of turboprop and piston transports totaled $175 million in 1956. . . . Orders included 38 Electras, 30 Super Constellations. Total Lockheed commercial backlog at year's end was $450 million.

▶**Lufthansa German Airlines** claims a New York-Shannon flight record Jan. 19 with a Super G Constellation. Plane flew the 3,072 mi. in eight hours, 30 min., Lufthansa says.

▶**United Air Lines** is pushing ski vacation sales with 11 winter tours to major U.S. resorts. Package prices range from $60 to $98 for seven days, air fare not included.

▶**Trans-Canada Air Lines** has begun daily Viscount service between Quebec City and Montreal. Second daily turboprop flight on the run is scheduled March 1.

▶**Belgian Congo** area is growing as travel attraction. Eight new hotels were built there last year, new hotel and motels are planned.

▶**Trans World Airlines** has signed three-year $750,000 contract to train Ethiopian Airlines pilots, maintenance employes and supervisory staff. Ten TWA specialists will set up schools in Addis Ababa for the program.

▶**Capital Airlines** has expanded Viscount service with three new non-stops New York-Norfolk; addition of a fourth New York-Washington flight; addition of an eighth non-stop New York-Detroit. Capital now has 56 Viscounts in service, expects delivery by this summer of last of order of 75.

▶**Vickers-Armstrongs** Aircraft is setting up a technical office in Trinidad to provide after-sales service to Viscount operators in the Caribbean area. Company now has offices in Washington, Montreal, Winnipeg and Adelaide, plans new one in Beirut.

▶**Cosmic ray study** will be made by scientists aboard Scandinavian Airlines System pre-inaugural flight from Europe to Japan. Scientific team will measure intensity of rays in polar region for International Geophysical Year.

AIRLINE OBSERVER

▶Watch for Administration to ask Congress for an increase in first-class postage rates from three to five cents, together with a recommendation that all first-class mail be moved by air on long haul routes. President Eisenhower warned in his budget message that $642 million will be required by the Post Office in Fiscal 1958 to make up for insufficient postal receipts unless rates are hiked to meet rising costs and higher Post Office salaries.

▶**Air Transport Assn. has decided to rewrite proximity indicator operating specifications. They will be submitted to airlines for review. The decision was prompted by new reports on proximity indicator development presented by several manufacturers, including Hughes and Bendix. Meanwhile, most observers feel that Phase II of the program, calling for a collision avoidance computer, is not yet attainable.**

▶Bermuda bilateral air agreement between the U. S. and Britain will undergo drastic revision when it comes up for review at Bermuda beginning Feb. 18 (AW Jan. 21, p. 25). The U. S. delegation will be in a much stronger position to barter than it was when the original treaty was signed 10 years ago. Since then, British airlines have fallen behind U. S. flag carriers in traffic handled, and Britain's loss of power in India, the Middle East and other areas have weakened her bargaining strength in trading international operating privileges.

▶**Airline meteorologists are scheduled to visit Strategic Air Command bases to study forecasts of jet streams, clear air turbulence and other weather conditions experienced by SAC in its high-altitude, long-range operations.**

▶Civil Aeronautics Board will conduct a "near collision" poll covering commercial, civil and military aviation. The survey will be similar to the program being conducted by the Air Transport Assn., which includes scheduled airline operations only. CAB is distributing a "check" type of printed form through aviation associations and military services. Pilots will return completed reports anonymously and without aircraft identification. Reports will be used for statistical purposes only and no action will be taken against any pilot or operator as a result of the reports.

▶**Trans American Airlines name case has been revived following a Supreme Court decision last week to review an appeal by American Airlines that the irregular carrier be restrained from using "American" in its name. Last spring, the Supreme Court refused to review a similar case fought by North American Aviation and thus upheld a lower court decision that prohibited the use of the airline's original corporate name, North American Airlines. At that time, the airline adopted Trans American Airlines as its official title.**

▶London Airport is constructing a long dirt ridge about 30 ft. high along one side of the airport near a residential area. Officials hope the hill will absorb engine run-up noise and reduce complaints from nearby residents.

▶**Civil Aeronautics Board will hold a hearing in Washington March 5 to investigate baggage allowances and excess baggage charges on domestic scheduled airline flights.**

▶Air Defense Command has issued new regulations which comply with requests submitted by the airlines during the past two years for improvements in ADC radar weather advisory service. Specifically, the airlines wanted and got authority to contact ADC direct, without going through air route traffic control centers for service; a "common" call signal, and a discreet frequency (133.2 mc.). ADC operates radar advisory service at 92 locations in the U. S.

▶**American Airlines has ordered two flight simulators from Erco Division of ACF Industries for early 1958 delivery. Erco will design and manufacture one simulator for the Lockheed Electra and one for the Boeing 707 to American's specifications. Both simulators will be housed in air conditioned trailers to permit movement to the airline's principal operating bases.**

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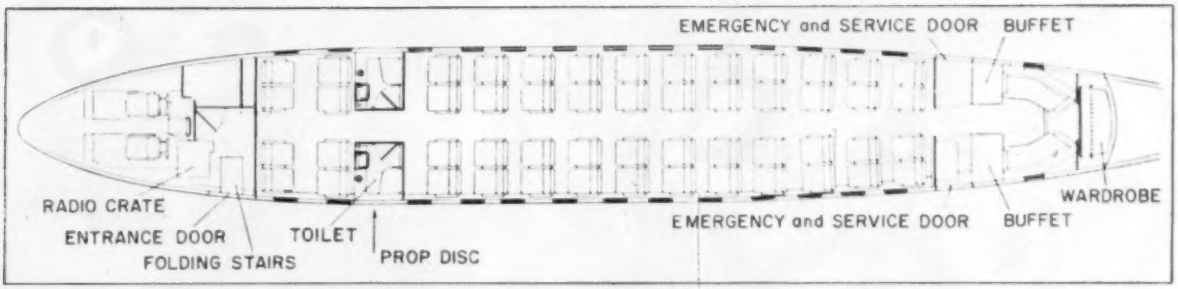


FOUR-SEAT aft lounge of 810.D (top), shows rectangular windows which were changed later to Viscount oval shape. Forward part of main cabin (below), looking into vestibule.

New Interiors Designed for Viscounts

Continental Air Lines' new Vickers Viscounts series 810.D turboprop airliners will have interiors designed by Charles Butler Associates of New York.

Innovation in the layout is the inclusion of a deluxe, four-passenger lounge in the rear of the plane. Butler reclaimed the area for passengers, thereby increasing the plane's first class seating capacity from 52 to 56 passengers. Other purchasers of this model Viscount use the space for buffet, and baggage and wardrobe.

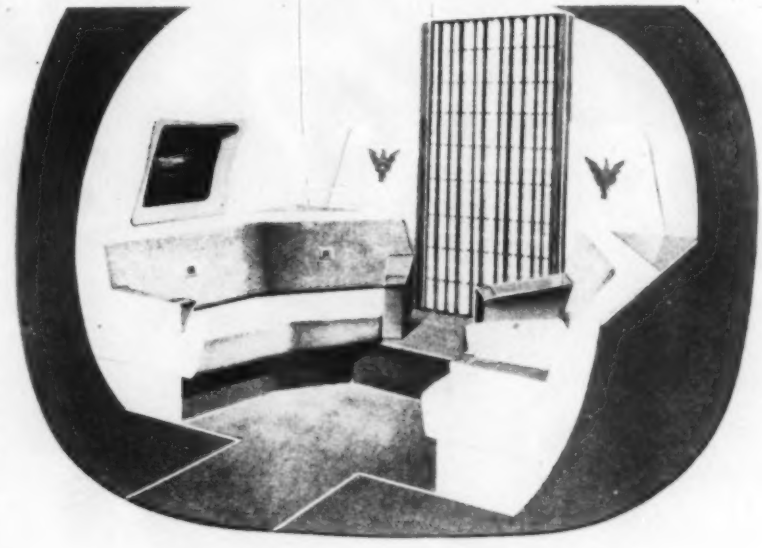
The plane's cabin is divided into four areas: an eight-seat forward lounge; a 44-seat, main passenger cabin; a galley which has two, full-size service and emergency doors; and the four-seat aft lounge.

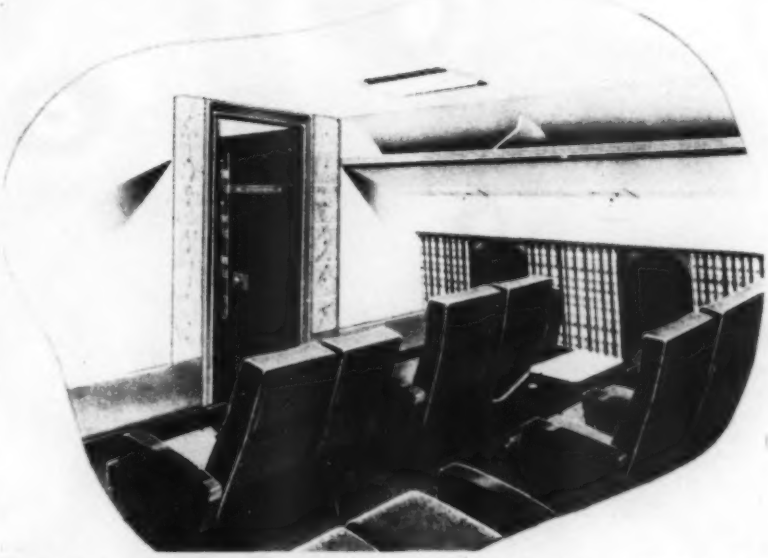
The seat covering and curtains are fabric, designed by Butler and made by Schumacher's of New York. The aisle runner is a carpet. All the rest of the cabin's interior covering—headliner, side walls and floor covering between and under the seats is a vinyl-coated fiber glass called Duracote, made by the Duracote Corp., Ravenna, Ohio. The material is extremely fire and scuff resistant, is easy to clean and comes in a large variety of textures and colors.

Color Scheme

- **Headliner** throughout the plane is tuscon blue—a light, airy hue.
- Side walls are birch white—an off-white.
- **Bulkheads** in the main cabin and aft lounge are also birch white, while bulkheads in the forward lounge are deep rose.
- **Seats** in both lounges are Eldorado blue—a somewhat deeper, richer hue than tuscon blue, but both blues blend easily. Seats in the main cabin are dawn—a pale peach color.
- **Aisle** runner is canyon—a soft rose.
- **Window** curtains—called Yellowstone—have a golden hue, drapery curtains, used in front of the galley and coat closet, are Yosemite, a teal blue plaid.

Special features of the interior in-





CABIN PLAN of Continental Air Lines' 56-passenger Vickers Viscount 810.D has two lounges, one fore, one aft.

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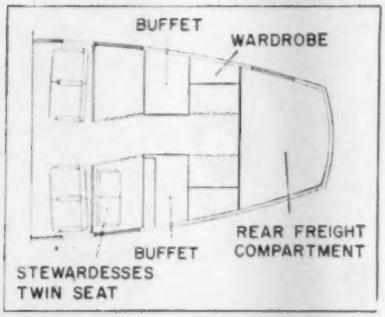

BUTLER ASSOCIATES uses wardrobe and freight compartment (above) for 4-passenger lounge.

clude: pinpoint indirect lighting on clear plastic which creates a starlight effect in the ceiling of the vestibule between the forward lounge and the main cabin. Two lavatories open off the vestibule.

Gold anodized aluminum is tastefully used throughout the plane as window frames and as extruded baggage rack trim.

All passenger service items—individual stewardess call buttons, reading lights, and ventilators, are grouped and conveniently located in the under part of the baggage rack.

Antique mirrors decorate the forward bulkheads of the aft lounge.

First Viscount 812 is scheduled for delivery to Continental in March 1958. All 15 aircraft on order are to be delivered by October of that year. CAL currently has an option for five more of the planes.

F-27 Orders Total About $24 Million

New York—Fairchild Engine and Airplane Corp. has sold 12 more of its F-27 transports for a total to date of 44, the company announced. Options on the high-wing turboprops total an additional 29.

The new customers are Northern Consolidated Airlines, scheduled Alaskan airline, with orders for three planes for passenger-freight operations; a South American airline, with five aircraft ordered; and three "large U.S. corporations" buying the other four. Fairchild withheld identity of the airline and the firms at customers' request.

Previous airline orders totaled 28, and eight orders have been placed by corporations, including General Tire and Rubber Company and Continental Can Company.

Fairchild still has a long way to go in selling the F-27 to reach its break-even point of 150 planes. The twin-engined plane now sells for $540,000, but its price will go up Feb. 15 to $590,000, according to R. James Pfeiffer, executive director of customer relations. Orders to date approximate $24 million.

Pfeiffer stressed the sale to Northern Consolidated as opening up a new market in the type of rugged, short-haul, passenger-cargo operations the Alaskan carrier flies. Sales to this type of operator are expected to provide an important market for the plane, Pfeiffer said.

The F-27 can carry 40 passengers or 9,500 lb. of cargo. Large forward cargo loading door is designed to facilitate mixed utilization. The Northern Consolidated planes will be equipped with a movable bulkhead to separate passengers and cargo.

First production F-27 is scheduled for late fall, 1957 completion at Hagerstown, Md. The airplane will operate in airline service early next year, Fairchild says.

Grumman May Build Safari for Frye Corp.

New York—Grumman Aircraft Engineering Corp. may build the Safari short-field transport for the Frye Corp. if Frye raises $15 million to set up an assembly line and begin production. The four-engined plane would be manufactured at Grumman's Bethpage, N. Y., plant under terms of a conditional agreement signed last December by the two firms.

The money Frye must raise to fulfill the agreement would cover production engineering, design and manufacture of tooling; material for 20 aircraft; and expenses through certification of the transport.

At the time of certification, according to Jack Frye, head of the Safari organization, deliveries of the plane to customers will begin. Two Safaris will have been completed by then, Frye said, an additional two will be nearly completed, and 16 others will be in various stages of construction. The work at that time will equal seven finished planes, according to Frye.

Under the agreement, the prototype airplane is supposed to be flying within 14 months after the $15 million is raised.

Frye also reported changes in the transport's specifications resulting from refinements in its design. Gross weight has increased from 37,000 lb. to 45,000 lb. Maximum payload in all-passenger configuration is up from 51 to 66 passengers. In all-cargo service, maximum payload has increased from 12,000 lb. to 18,000 lb.

Price of the plane, now related to Grumman costs, is now expected to approximate $425,000 without engines, Frye said. Figure compared with previously announced price of $365,000.

MILITARY FIELD SERVICE

an integral part of Burroughs responsibility for computation in SAGE

For its vital computation phase of SAGE (continental air defense system) Burroughs responsibility to the Air Force begins with research . . . extends through engineering, development, production, testing, and installation . . . and includes essential field training, service and engineering.

Resident teams of Burroughs Military Field servicemen are assigned to each SAGE site. These specialists install and continually test each computer, executing field service functions through intimate knowledge of the equipment.

Already, scores of Burroughs specialists are on Military Field Service duty at home and abroad, wherever they are required to service complicated equipment.

This is another demonstration of Burroughs *complete* systems responsibility for numerous Armed Forces projects embracing instrumentation, control systems, communications, electronic computers, data processing.

In the areas of our proved capabilities, we welcome further inquiries. Call, write or wire Defense Contract Organization, Burroughs Corporation, Detroit 32, Michigan.

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Looking to continuing expansion, Burroughs invites inquiries from qualified engineers.

Another reason why G.E.'s newest turbojet
MORE THAN 31,000 JET ENGINES have been designed, developed and produced by General Electric since 1941. The CJ-805, latest G-E powerplant scheduled for production, will enter airline service in 1960 in new TWA and Delta Air Line Convair Model 880's.

makes possible the ideal medium-range jetliner

General Electric CJ-805 Offers Lowest Operating-Maintenance Cost of Any Airline Turbojet

Fact: the General Electric CJ-805 will be the most economical medium-range jetliner engine to own, operate and service. These four key reasons tell why:

1. $22/hr guaranteed maximum parts cost in fleet operation—The performance of the CJ-805, commercial counterpart of the supersonic J79, promises to set a new low in parts-replacement cost. Chief reason is the engine's sturdy, all-steel, single-rotor design.

2. Low overhaul cost—Here are the factors that back up the low overhaul cost projection for the CJ-805:

- Based on the record time-between-overhaul of G-E J47's installed in the multi-engine B-47, the CJ-805 promises to have a time-between-overhaul much higher than that of present commercial engines.
- Based on G-E factory overhaul of 5000 J47 engines, it is estimated that the CJ-805 will require only 750 man-hours to overhaul.
- The guaranteed maximum parts cost of $22 per engine flying hour covers overhaul *and* line maintenance on a fleet basis.*

These projections are possible because the CJ-805 is an evolutionary engine based on design principles proved in thousands of G-E turbojets.

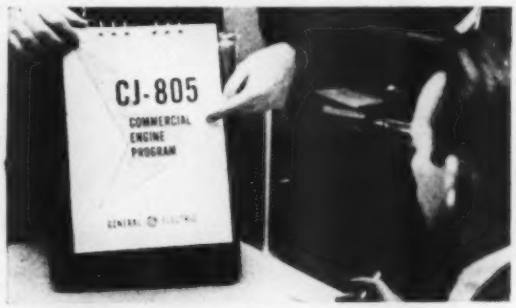
3. Low fuel consumption—The CJ-805's excellent performance, a result of its high compression ratio, provides maximum engine economy under all flight conditions.

4. Purchase price—The CJ-805 will give you more thrust per dollar invested than any other commercial turbojet in the world.

For further details, contact your G-E Aircraft Engine Specialist. You can reach him via your nearest Aviation & Defense Industries Sales Office. *General Electric Company, Cincinnati 15, Ohio.* 237-7

*For two-year period after initial airplane delivery.

CJ-805 DEVELOPMENT PROGRAM IS UNDERWAY at Evendale, Ohio. Already tests show that the engine's excellent operating economy—the result of small size, light weight, low S.F.C. and high thrust—promises extra profit for your commercial airline operations.



AVAILABLE TO QUALIFIED AIRLINES is a comprehensive presentation on why the CJ-805 makes possible the ideal medium-range jetliner. Your General Electric Aircraft Engine Specialist will be glad to go over this flip-chart with you, at your convenience.

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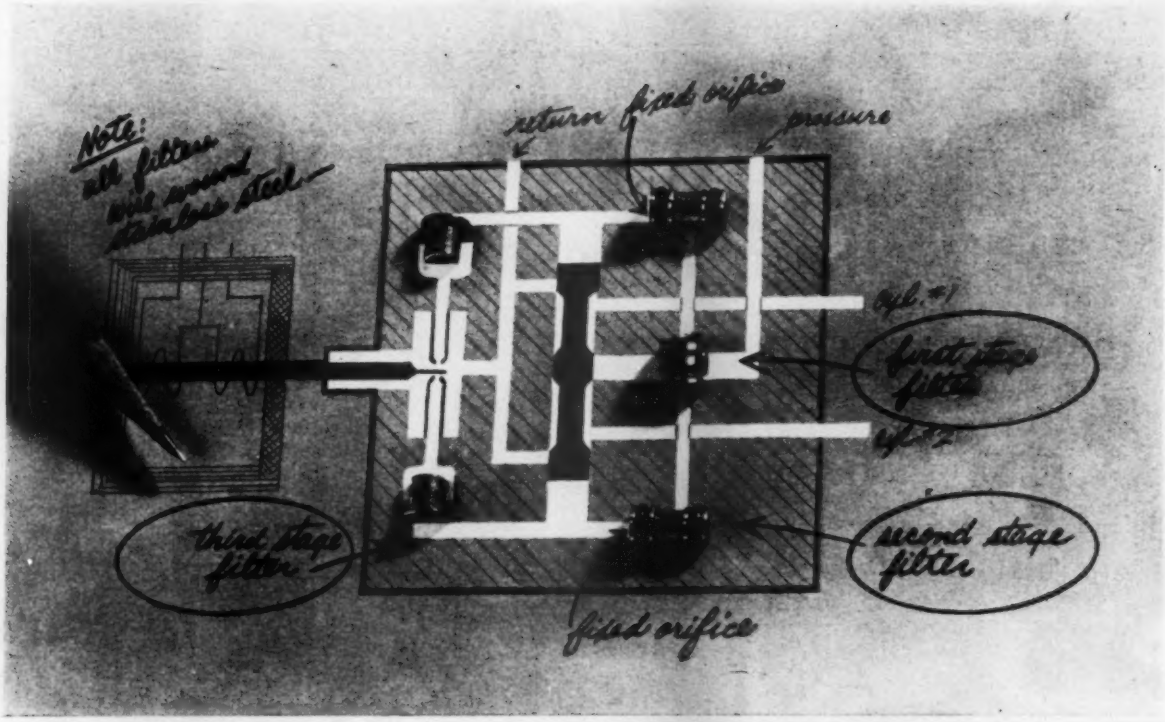

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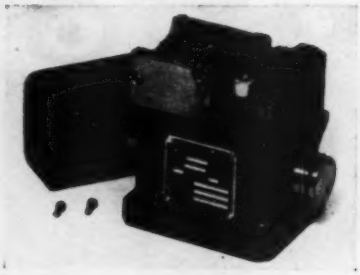
In the first stage the inertia of particles entrained in the flow stream supplements basic filtration. Filter life is enhanced by the washing action of main valve flow on the filter's inner surface.

Second and third filtration stages are strategically located to protect the orifices and nozzles from any possible contamination from within, as well as any that might pass through stage one.

All five filters are wire wound stainless steel. Wire size and winding pitch are accurately controlled for extremely sharp particle size cut-off.

Torque motor is dry coil construction. Coil and magnetic circuitry operate entirely in air media to prevent magnetic particle build-up found in wet coil construction. Stainless steel, unitized power stage provides excellent null stability at varying temperatures.



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Trans-Australia Breaks Traffic Record

Melbourne, Australia—Trans-Australia Airlines carried the Australian airline record of 773,144 passengers on scheduled flights to 94 Australian locations during 1956.

This exceeds the previous record, set by TAA in 1955, by 33,361 passengers and shows a 22% increase in passenger traffic volume in the last two years. Total passenger mileage of 374,576,022 shows an increase of nearly 7% over last year's figures and constitutes another Australian record.

The airline's fleet of nine Vickers' Viscount planes carried over 400,000 passengers with a load factor of 85 out of 100.

Ordinary air cargo totaled 36,007,922 lbs. (36,967,663 lb. in 1955) but Air Express service cargo rose by 158,897 lb. to a new record level of 1,334,240 lb.

Flights numbered 27,874 and covered 16,593,000 miles in 93,172 flying hours over unduplicated routes totalling 31,391 route-miles, an increase of nearly 1,000 route-miles.

Charter flights accounted for additional 1,188 passengers and 308,654 lb. of cargo.

French May Order Jetliner Cutbacks

Paris—Dollar-short French government may order Air France and two private French airlines to scale down plans for equipping their fleets with American jetliners.

Proposed cutback would affect jetliner orders already placed by the two private lines as well as current Air France plans for placing additional jet orders. French government, mainly because of its dollar account problem, has the right to veto such plans. Veto would not be final, but could be reconsidered at some future date, presumably when France strengthens its dollar holdings.

Proposed cut would mean that Transports Aeriens Intercontinentaux (TAI) would be entitled to only two of the four Douglas DC-8 jets it recently ordered. An order by Union Aeromaritime de Transport (UAT) for five Douglas DC-8 jetliners would be cut back to three. Both lines have protested vigorously against the proposal.

For Air France, the cutback would come not on orders already placed but on new jet equipment plans. The state-run line wants to order 14 jets on order similar to the transcontinental versions of Boeing and Douglas jetliners or the Convair 880. Under the cutback proposal, instead of 14 jets of this type, Air France could order only eight.

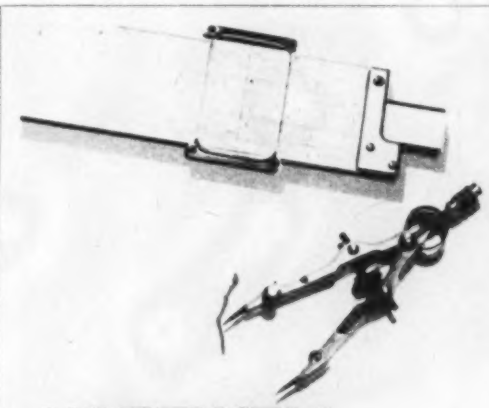
Air France's initial jet order for 10 long-range Boeing 707s placed early in 1956 still stands, as its initial order for 12 Caravelles does. Air France has options on an additional eight long-range Boeing jetliners plus 12 more Caravelles. It is possible these options may not be picked up as quickly as the line planned.

Proposed jet equipment slowdown stems from recent hearings held by the influential French High Council for Commercial Aviation. This group includes 25 high ranking civil servants from various ministries. Cutback was its advice to Transport Minister Pinton, with whom the final decision rests. Usually recommendations of the High Council are accepted by the government. It is understood additional pressure in favor of the cutback is being made by Finance Ministry.

Czech Airline to Buy Tu-104s in 1957

Vienna, Austria—Czechoslovakia plans to purchase three Tu-104 craft for the CAS (Czechoslovakian Airlines) during 1957.

This announcement, made by the Prague press recently, said "experienced



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Czech pilots and ground crews have been selected for schooling in the USSR."

The state-owned and state-operated AVIA Aircraft Factory of Prague announced on January 8, 1957 that this enterprise plans to build four-engined craft in the near future. No information was released as to which types of (Soviet) aircraft will be built.

The CSA will get five more twin-engined Il-14 craft during the first quarter of 1957. The Il-14s are now being built by the AVIA Works under Soviet license. Owing to specifications of CSA, the seating capacity has to be increased from 18 to 22 and the interior decorating adapted to suit the taste of passengers. Five more Il-14s are to be delivered during the third quarter of 1957 by the AVIA works, but this group will have a longer fuselage and a seating capacity of 24 seats.

Styling Design Set For Convair's 880

New York—Convair Division of General Dynamics Corp. has engaged two firms to handle the design and styling of interiors for its Convair 880 turbojets, the manufacturing company announced. Harley Earl, Inc., industrial designers will design the interiors and Dorothy Draper, Inc. will act as styling consultant.

Convair has completed a $225,000 steel mockup building at its San Diego plant and has installed two mockups of the medium-range airliner (AW Jan. 21, p. 65).

Orders for the 880 total 40 to date. Trans World Airlines has ordered 30, Delta Air Lines the other 10.

New Military Reserve Airport Recommended

Washington—A new airport to handle military reserve flying activities was recommended for the St. Louis area last week by the Airport Use Panel of the Air Coordinating Committee.

In a unanimous decision, the panel recommended that the Department of Defense start laying plans for development of a new airport in the Missouri environs of St. Louis to relieve congestion at Lambert Field, the present municipal airport.

Under the plan, the Defense Department would develop a new field for the use of Naval Air Reserve and Air National Guard units now stationed at Lambert Field. The group also recommended that McDonnell Aircraft Corp. flight testing be removed from Lambert as soon as practical—possibly to the new airport.

When a site is selected for the new airport, the panel suggests that government and local officials meet to determine whether it is practical for joint civil and military use. If so, the group recommends that a master plan be prepared, and that financial arrangements and provisions for operational and maintenance facilities be made.

If joint use of the new airport is not feasible, the panel recommends that plans be initiated for development of additional all-weather civil airport facilities in the St. Louis area. Planning and development of any additional airports in the area, as well as treatment of airspace problems and air traffic control problems, should be coordinated with proper local and federal agencies before final approval of sites involved, according to the panel.

Chilean State Airline Has First Operating Profit

Buenos Aires—Chilean State Airline, LAN, will show an operating profit on its 1956 balance sheet for the first time since it began operations in 1928.

The line has contracted to buy four DC-6s for delivery in the last half of 1958. The management of LAN believes that the DC-6B is the tourist flight plane of the future, to replace the DC-4.

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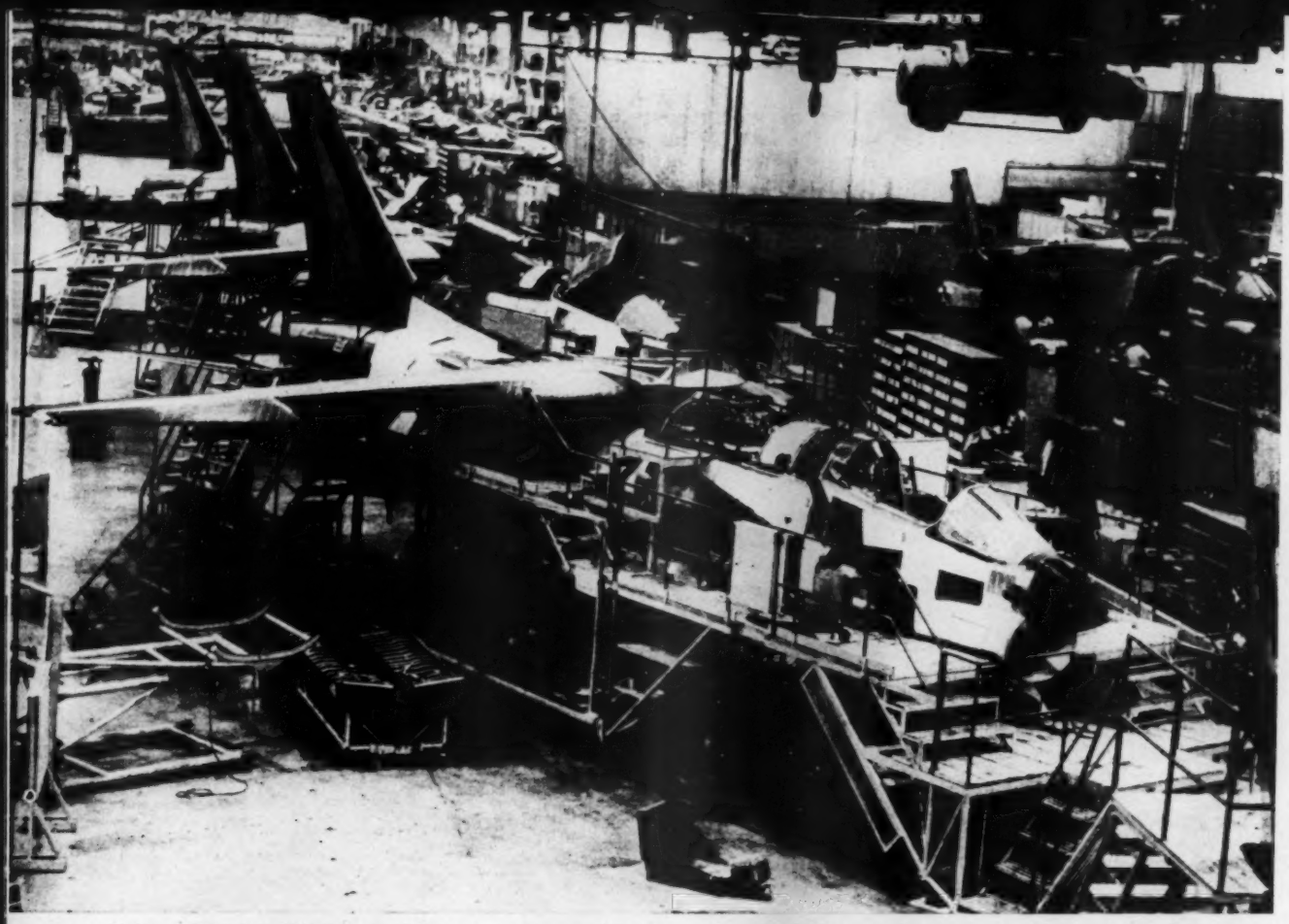
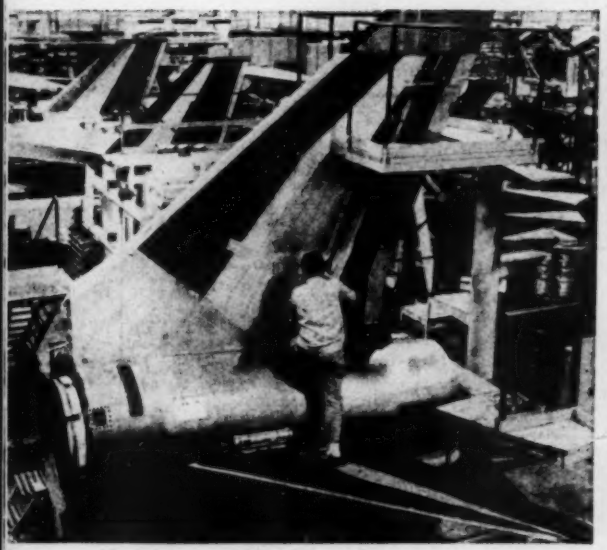
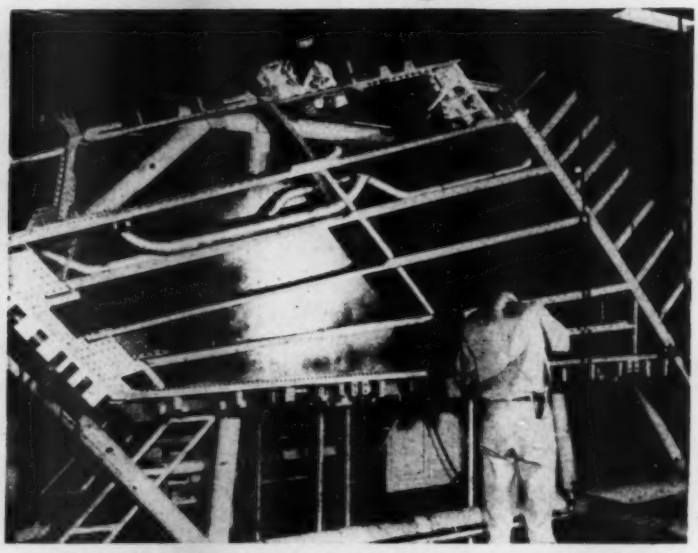


CHANCE-VOUGHT F8U-1 carrier fighter, expected to reach fleet squadrons in March, was production engineered even before the prototype was built and required no production adaptation. From the sequence of operations, the airplanes appear to move down the line tail-first. Rocket pack and ejection seat on floor are about to be installed.

F8U-1 Was Production Engineered

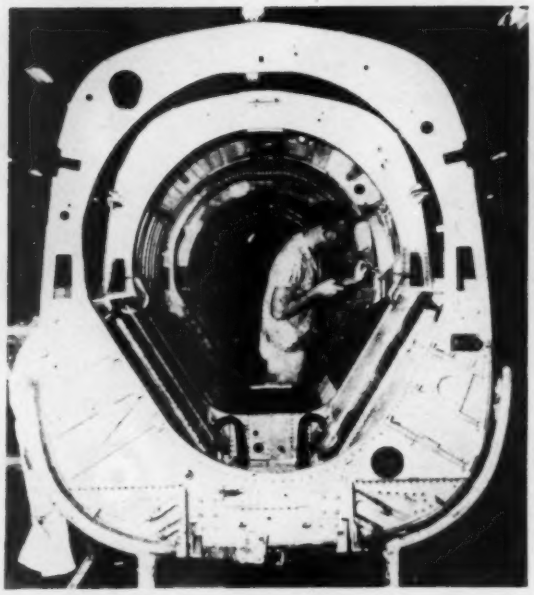


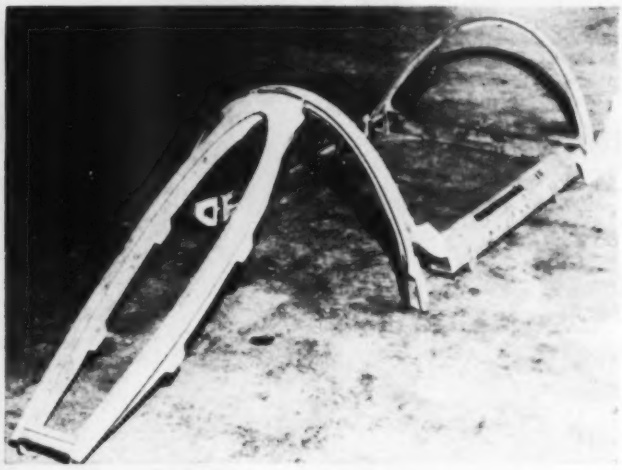
HORIZONTAL SLAB tail is driven by power package above its root. Package is replaced as unit, bench repaired, adjusted.

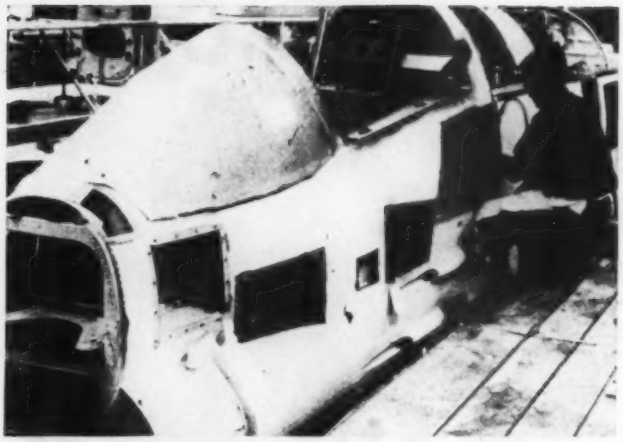


INTEGRAL WING TANKS are sealed on wing sub-assembly line. Sealing is completed after sculptured skins and two wing stubs are joined. Variable incidence wing pivot rib is at right and wing fold rib is at left.

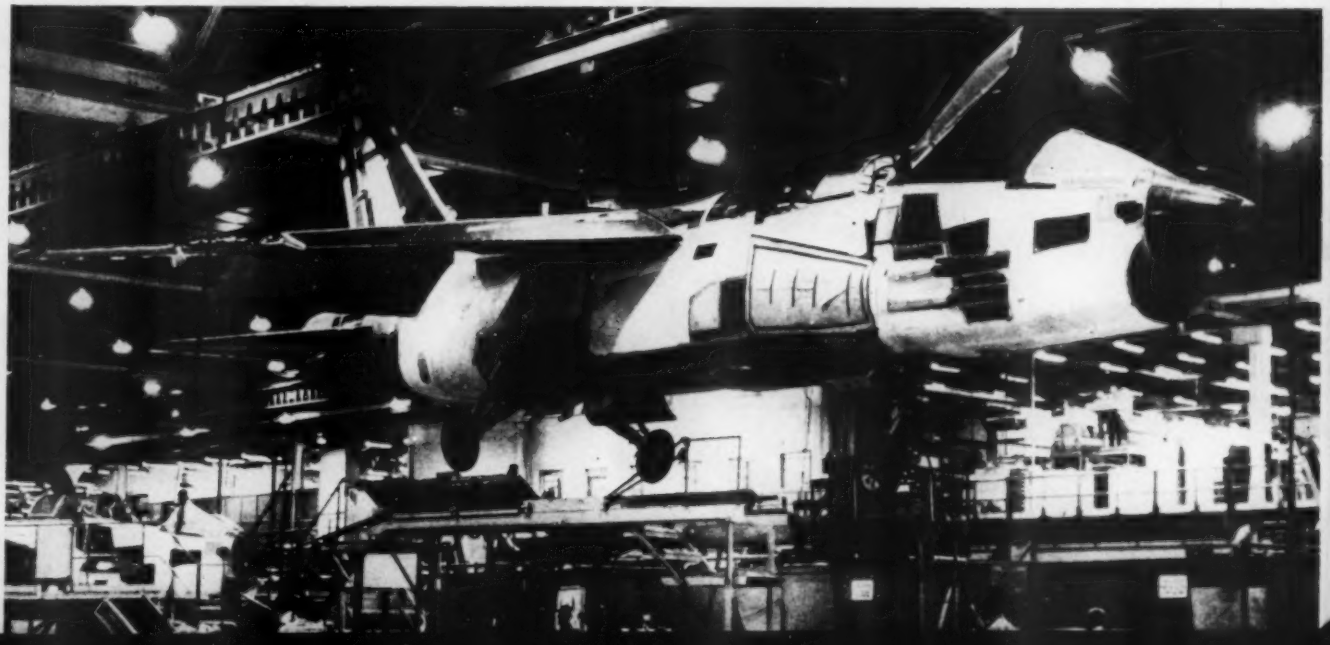
PRODUCTION







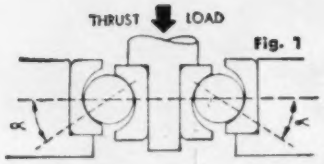
DENSITY OF DESIGN is indicated in fuselage center section sub-assembly (above). Slant-panel compartments contain classified equipment. Cast magnesium windshield and canopy frames (above right) are lighter, cheaper and more producible than traditional built-up or welded structure. Four castings form major portion of canopy frame; front hoop, rear hoop and canopy hinges and a box section rail on each side with integral locking lugs. Wall thicknesses of non-ferrous alloy castings may be as low as 0.01 in. and tolerances may be held to ± 0.010 in. Characteristic of the F8U is great number of access doors for ease of maintenance. Oxygen and pressurization components are installed behind cockpit (right) and serviced from outside. Dark areas in skin (below) are magnesium alloy. Inner wing and outer wing are sculptured magnesium sheet. The light alloy constitutes 25% of wing and fuselage skin.

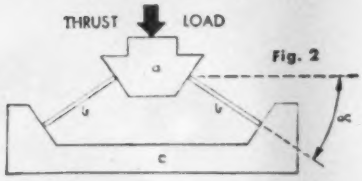


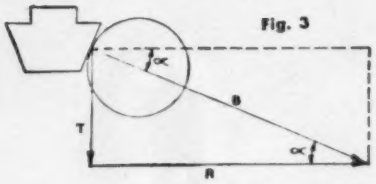
ENGINEERING BULLETIN
ON MICRO-BEARINGS
Miniature Instrument Ball Bearings

NEW HAMPSHIRE BALL BEARINGS, INC.
PETERBOROUGH 1, NEW HAMPSHIRE

Subject: CONTACT ANGLE







THRUST LOAD CONSIDERATIONS

Contact angle is the angle between a plane perpendicular to the bearing axis and a line connecting the two points on a given ball where the ball makes contact with the raceways when the bearing is subjected to a pure thrust load. In *Fig. 1*, the contact angle is represented by angle *a*. The significance of the contact angle is revealed by an examination of the forces present in a thrust loaded bearing.

In *Fig. 2*, a simplified version of *Fig. 1*, the shaft and inner ring combination are represented by the plug *a*, the "working diameters" of the balls are represented by the rodlike members at *b*, and the outer ring is represented by the tapered cup *c*.

The contact angle is *a*. This diagram represents a three-dimensional structure with as many equally spaced rods, *b*, as there are balls in the bearing.

The primary concern in design is the amount of compressive force to which rod *b* is subject, which is the force with which a given ball is pressed against the raceways. This force can be calculated by constructing a parallelogram of forces as shown in *Fig. 3*.

The sides T and R, are vector quantities, and diagonal B is the vector sum of T and R. Furthermore, the vector sum of the thrust components on all the balls equals the total thrust load on the bearing. The vector sum of the radial components on all the balls is zero. Vector B, the force actually felt by the raceways and balls, compared to vector T, the thrust component, varies significantly with changes in the size of the contact angle and is directly proportional to the thrust load component and inversely proportional to the sine of the contact angle.

Example I:
A bearing is carrying a pure thrust load of 21 pounds. Assuming seven balls in the bearing, each ball will have an axial load component of three pounds, since a thrust load is shared equally by all the balls. While the axial component on each ball is only three pounds, the actual compressive force, or squeeze, felt by the ball and raceways is considerably greater than this value.

With a contact angle of five degrees:

$$B = \frac{T}{\sin \alpha} = \frac{3 \text{ pounds}}{\sin 5^\circ} = 34.5 \text{ pounds}$$

Thus we see that with a five-degree contact angle the actual load felt by each individual ball is actually considerably greater than the total 21 pound thrust load on the bearing.

Example II:
Using the thrust conditions in Example I, the contact angle is increased to 20 degrees, by selecting a bearing with a larger value of radial play.

$$B = \frac{3 \text{ pounds}}{\sin 20^\circ} = 8.78 \text{ pounds}$$

A 15 degree increase in contact angle produced a 74.5% reduction in ball-to-raceway contact stress. This relationship should be noted by anyone who writes bearing specifications. The operational qualities of the bearing, such as low running and starting torque and bearing life, are a function of the ball-to-raceway contact stress. Thus the contact angle is highly significant.

It is not necessary for a bearing user to calculate or specify the contact angle desired. It is only necessary to remember that low values of contact angle are associated with low radial play, and high values of contact angle are associated with high radial play.

While the advantages of large contact angle have been examined above in some detail, there is one important factor which, in high speed applications, places a restriction on the magnitude of contact angle for optimum bearing performance. This is the matter of gyratory forces on the balls. Each ball in a bearing may be visualized as a little planet rotating on an orbit represented by the pitch circle of the bearing, while at the same time rotating about an axis of its own. It is this latter mode of rotation which concerns us at the moment. Every rotating body exhibits gyroscopic characteristics which vary in magnitude with the speed of rotation. Most important of these characteristics is the reaction of the rotating body to changes in the direction of its axis. Now the axis of rotation of a ball in a bearing is represented by a line which passed through the center of the ball and which is perpendicular to the line connecting the points of contact with the raceway. This means that the angle between the axis of ball rotation and the axis of the bearing is equal to the contact angle *(see Fig. 4)*.

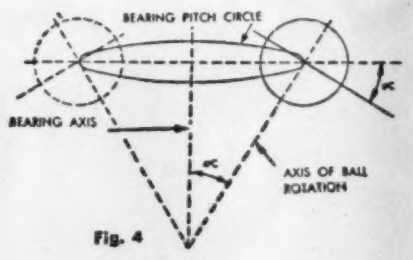


Fig. 4

As the ball travels around its pitch diameter orbit, the axis of ball rotation is forced to change constantly. Specifically, the gyratory moment acting on a ball is proportional to, among other factors, the sine of the contact angle. Thus as the rotational speed is increased, a point will be reached where the gyratory forces acting on the balls will produce slippage between the balls and the raceways. This induces increased operating temperature as well as premature bearing failure.

Thus in high speed applications, optimum bearing performance is a compromise between high contact angle for minimum ball-to-raceway stress, and low contact angle for minimum slippage between balls and raceways.

RADIAL LOAD CONSIDERATIONS

With a pure radial load, the load at any instant is not shared equally by all the balls as in the case of thrust loading, but is supported by three or four balls at most. The higher the radial play, the greater is the tendency for the load to be concentrated on one or two balls; while the lower the radial play, the more the load is apt to be distributed on three or four balls. This more even distribution of load in radially loaded bearings with low radial play is reflected in reduced torque and extended bearing life.

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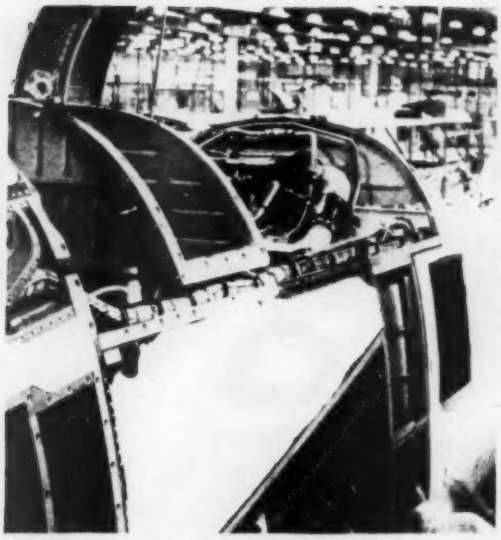
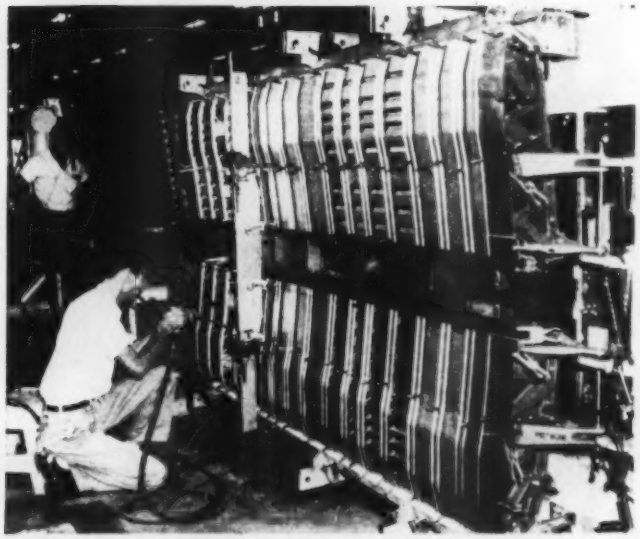
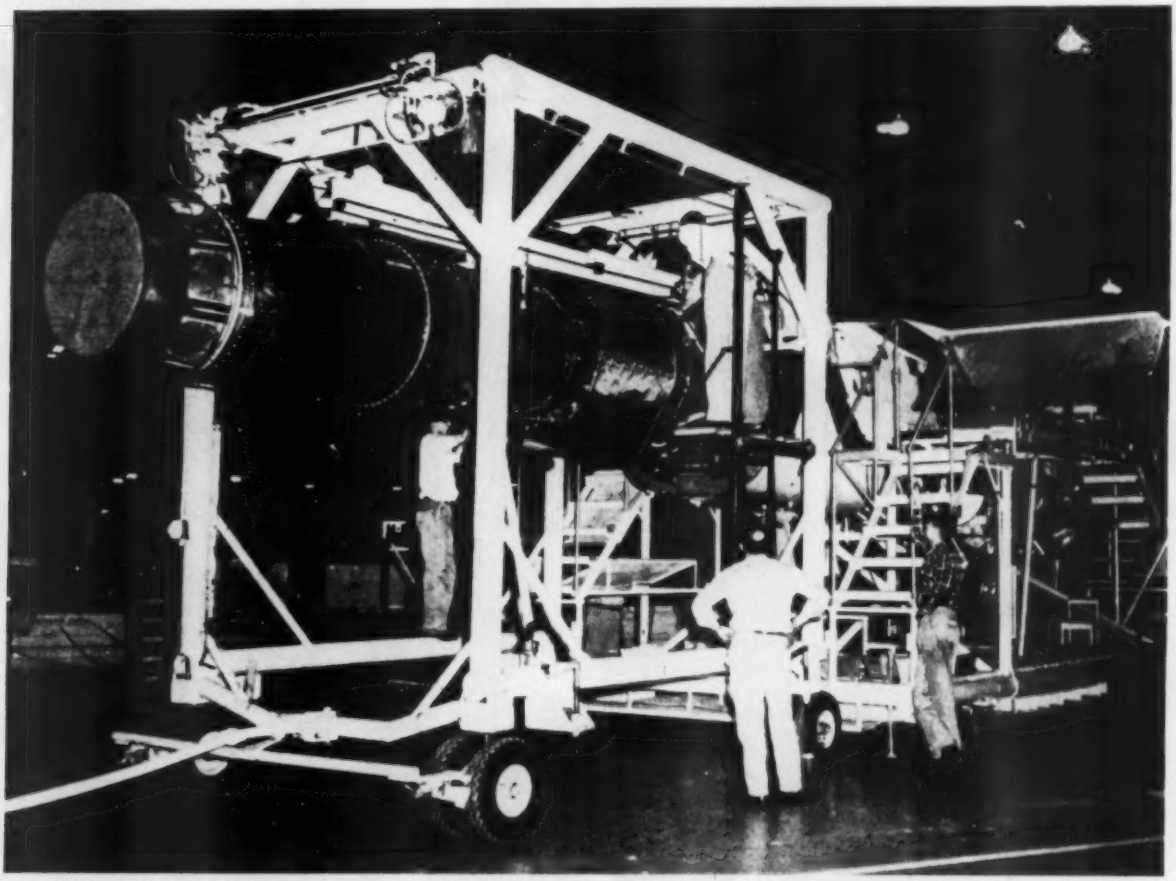


GROUPING OF WIRING is emphasized for producibility. Bundles of wires from cockpit to variable incidence wing, engine compartment and tail section are formed and cut on assembly board, checked out as unit on simulator and lowered into channels on each side of midsection.



RETRACTABLE ROCKET PACK carrying eight air-to-air missiles is main battery of F8U. Tubes have closed breech. Combustion products are vented forward. Extrusions and castings are widely used in the pack to cut weight and cost and increase producibility. The remainder of the airplane's internally stored firepower consists of four 20 mm. cannon.



NEARING THE END of the final assembly line, F8U has Pratt & Whitney J57 engine installed from high, wheeled dolly. Engine is lifted by powered cable and pulley system and positioned by sprocket and chain driving carrier jig along I-beam rail.

Prudential to Build, Lease to Lockheed

San Francisco—Lockheed Aircraft Corp. has made a deal with Prudential Insurance Co. which calls for Prudential to build a $14 million missiles development in the San Francisco Bay Area planned by Lockheed. Prudential then will lease the facilities to Lockheed.

This arrangement will allow Lockheed to preserve working capital needed for other projects. Citing other plant expansion under way (for nuclear work and for production of the Electra propjet transport), Lockheed Secretary Frank L. Fram said, "We must exercise financial stewardship of the highest order to maintain the working capital to enable us to keep stepping up to these new technical opportunities."

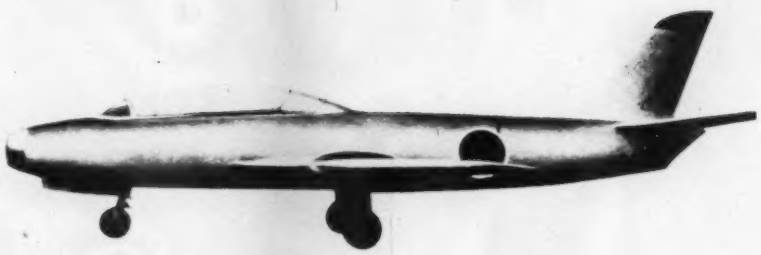
The company believes it is first aircraft manufacturer to try this system of obtaining major plant facilities.

The switch to Prudential ownership came when construction was already under way on Lockheed Missiles Division facilities at Sunnyvale and Palo Alto.

Facilities at these two sites, to be completed within 18 months, will total about 500,000 sq. ft. of office, manufacturing and laboratory space. Lockheed has said further expansion at the two sites might boost total investment $30 million.

Prudential and Lockheed have negotiated 25 year leases on the Bay Area plants, with options to renew.

In addition to the Bay Area construction, the Missiles Division recently acquired 4,000 acres near Santa Cruz for a $1 million missiles development, testing and research center. Construction is to start next summer.



Japanese Trainer

Final configuration of Japanese Fuji T1F1 trainer is shown in this drawing of the plane. Construction has begun and estimated first flight date has been set for the fall of 1957. Powerplant will be a version of the Bristol Orpheus, lightweight turbojet gaining favor as engine for light fighters and trainers. Full-scale mockup of the T1F1 was inspected recently by Technical Research Institute of the Japanese Defense Agency and the Air Self Defense Force Training Command.

A little pull in the right place . . .

the ROBINSON wire twister

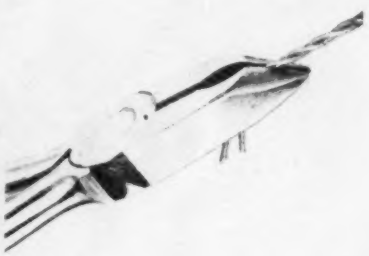
Aircrafts' Who's Who Reports

A cross section of the Who's Who in the aircraft industry—including Douglas, Allison, Fairchild, Grumman, Martin, Republic, Canadair Ltd., Pratt and Whitney among a host of others — is reported to have reduced engine wiring time as much as 66⅔. This saving is effected by the use of the new Robinson Wire Twister, an improved model of the ones that have seen service with the army, navy and airforce since 1943. Improvements include the exclusive diagonal jaw design that permits easier access to hard-to-reach areas, and clamps a vice like grip on the wire by pulling it into a 30° bend thus delivering added leverage for twisting.

In addition to the greatly increased engine wiring speed, users attest to improved shop safety — fewer skinned knuckles and bruised fingers.

Besides their production line assignments, Robinson Wire Twisters readily adapt in the shop to bench work, on radio and radar equipment, on magnetos, carburetors, instruments and sub-assembly work of all kinds.

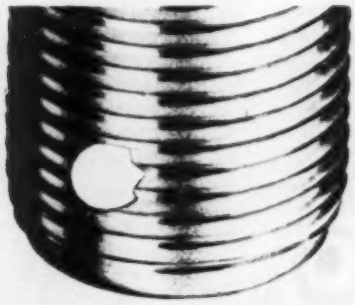
List price is $18.50. Write for fully descriptive literature to Ralph C. Robinson Company, Dept. W, Box 3494, 2516 Crosby Way, North Sacramento 15, California.



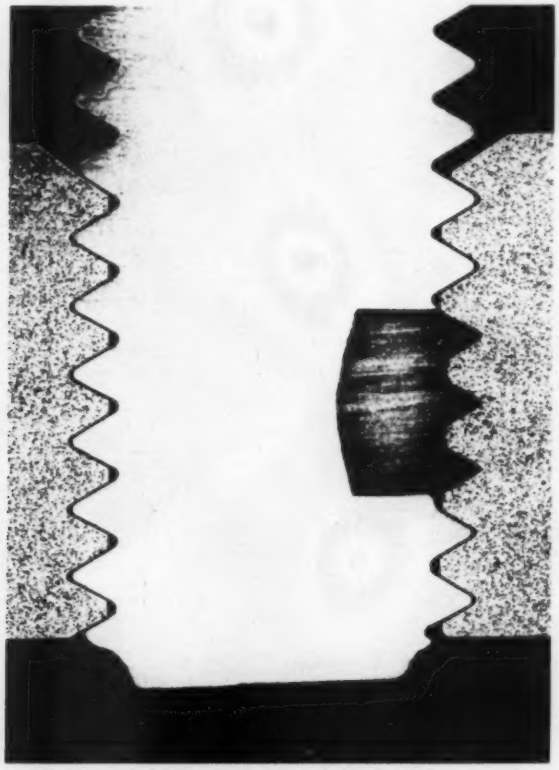
. . . saves ⅔ the usual wiring costs

the ROBINSON wire twister

NEW—SPS aircraft bolts with the Nylok* self-locking device



THE NYLOK SELF-LOCKING DEVICE consists of a nylon pellet permanently installed in the threaded section of the bolt. It completely eliminates the need for all other locking devices, including expensive, time-consuming lockwiring. It is available in all standard and special SPS and Cooper fasteners with male threads.



HOW IT WORKS. Threads of tapped hole or nut compress the nylon pellet out of its original shape. Compression in pellet exerts continual force against mating threads—locks the bolt positively. Bolts are reusable.

Vibration cannot shake them loose. They simplify design and save production time.

SPS aircraft bolts are now available embodying the Nylok self-locking device, which provides a truly practical new solution to the problem of making bolts self-locking.

A self-locking SPS aircraft bolt is a single unit. No auxiliary locking devices are needed. Just thread the bolt into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not shake loose.

You save production time when you assemble aircraft with self-locking SPS bolts. You get more simplicity in design, with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Expensive drilling and deburring of heads for lockwires is eliminated. So is the installation of lockwires—a costly, tedious, time-consuming process, especially where bolts must be installed in cramped, inaccessible places. And the nylon pellet locks the screw positively—while lockwires frequently permit the screw to back off slightly under vibration and lose its preload. These bolts save maintenance time, too—no lockwires to cut and untangle and reinstall.

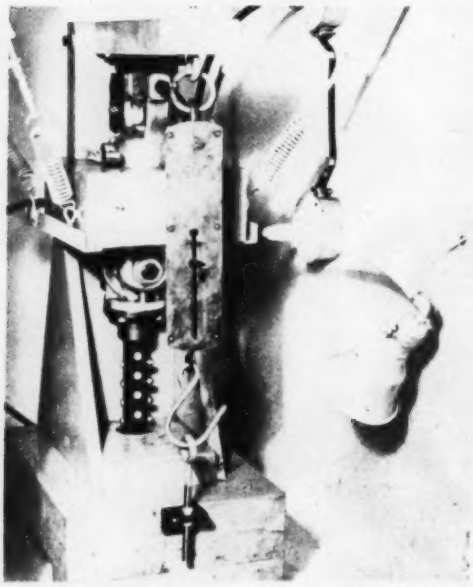
Self-locking SPS aircraft bolts are reusable. They have uniform locking torque and low installation torque—with no galling or seizing on mating threads. They successfully withstand temperatures from −70 to 250°F.

SPS manufactures male-threaded fasteners with the Nylok self-locking device in standard or special configurations—for use in conventional applications and in many places where bolts cannot be locked by any other means. The Nylok device is also available in fasteners manufactured by Cooper Precision Products, an SPS subsidiary.

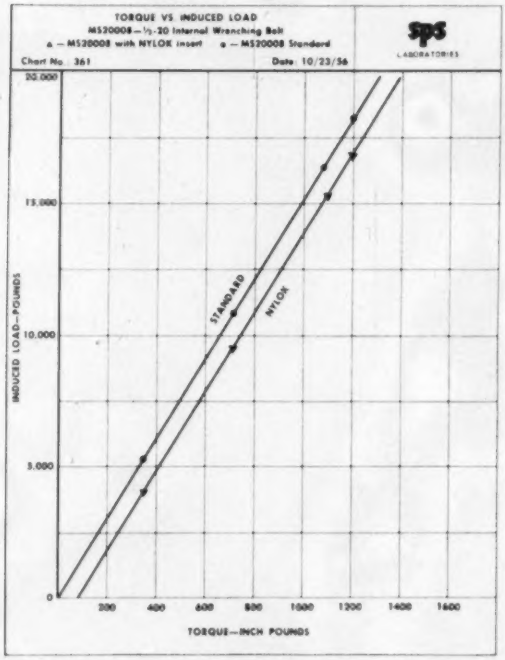
Write us for complete information on SPS self-locking threaded aircraft fasteners today. Aircraft Products Division, STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

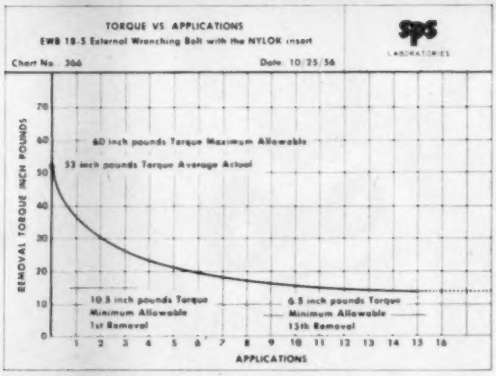
Lab tests prove self-locking SPS bolts are safe and strong



VIBRATION RESISTANCE. Exhaustive vibration resistance tests, conducted in the equipment shown above, proved that self-locking SPS fasteners, properly tightened, maintain their preload under exceptional conditions.



INDUCED LOAD. Curve shows difference in torque required to produce equal bolt loads with use of a standard aircraft fastener and a self-locking SPS fastener. The fastener with the Nylok device displaces the standard curve uniformly by an amount equal to the unloaded prevailing torque.

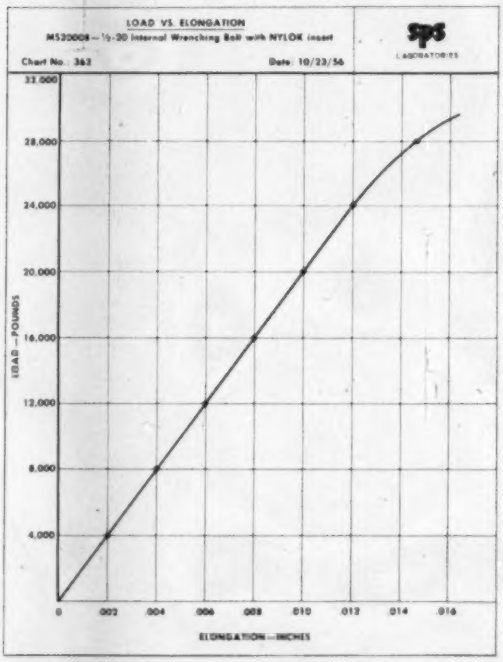


REMOVAL TORQUE. Curve shows removal torque in inch-pounds through the 15th application. Even after being inserted and removed from a tapped hole more than 15 times, the SPS fastener retains a value well above the minimum allowable torque of 6.5 in.-lb.

COMPARISON OF TENSILE STRENGTH
SELF-LOCKING MS BOLT VS. STANDARD MS BOLT

Sample No.	Tensile strength—pounds	
	MS 20008 with Nylok Insert	Standard MS 20008
1	29,575	29,400
2	29,250	29,575
3	29,400	29,725
4	29,850	29,600
5	29,600	29,810

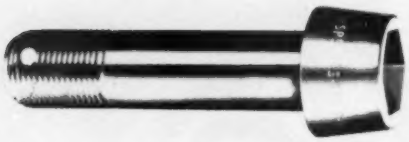
TENSILE VALUES. Tensile strength comparison shows that there is no significant difference in tensile strength between a standard SPS aircraft bolt and a comparable SPS bolt with the Nylok* device added.



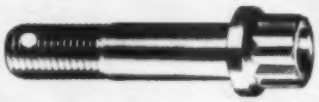
LOAD VS. ELONGATION. Test proves conclusively that the Nylok pellet has no effect on the strength of the fastener. It shows a continuous uninterrupted curve, with values identical to those for a comparable standard bolt.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

SPS aircraft fasteners with the Nylok* self-locking device

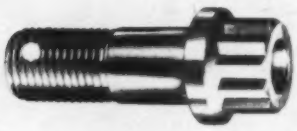


Internal wrenching bolt
NAS 144 through 176 type
Manufacturing Specification NAS 159



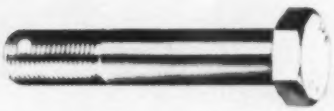
12-point external wrenching airframe bolts

Internal wrenching bolt
UAB 428 through 2424 type
Manufacturing Specification NAS 159

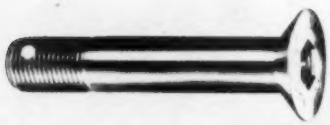


12-point external wrenching engine bolts
MS 9033-05 through 9039-52 type
Manufacturing Specification AMS 7478

Internal wrenching bolt
MS 20004 through 20024 type
Manufacturing Specification MIL-B-7838a



6-digit external wrenching bolt
Manufacturing Specification AMS 7452 or 7472



100° flush head shear bolts
NAS 333 through 340 type
Manufacturing Specification NAS 498

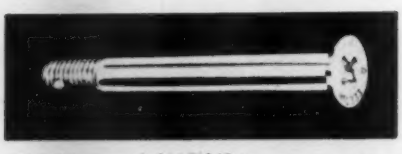
6-digit internal wrenching bolt
Manufacturing Specification AMS 7452 or 7472

Aircraft fasteners in many hundreds of special configurations are manufactured by SPS. All special fasteners with male threads can be equipped with the Nylok device.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

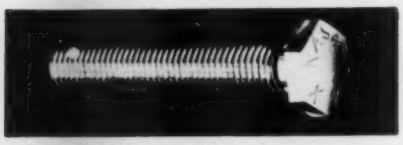
Cooper aircraft fasteners with the Nylok* self-locking device

AN 3 through AN 20 type
Manufacturing Specification MIL-B-6812

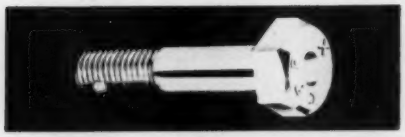


NAS 333 through NAS 340 type
Manufacturing Specification NAS 498

AN 21 through AN 36 type
Manufacturing Specification MIL-B-6812

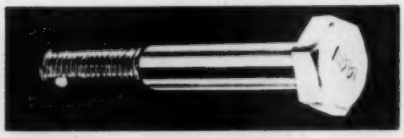


NAS 428 type
Manufacturing Specification MIL-B-6812



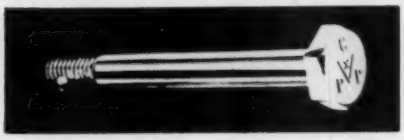
NAS 1303 through 1320 type
Manufacturing Specification MIL-B-7838

NAS 464 type
Manufacturing Specification NAS 498

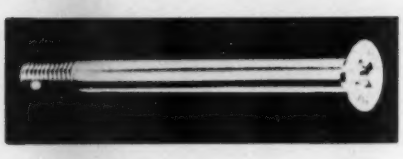


AN 6-digit engine bolt type
Manufacturing Specifications AMS 7452 and 7472

NAS 501 type
AMS Type 321 corrosion-resistant steel



AN 173 through AN 186 type
Manufacturing Specification MIL-B-6812



NAS 517 type
Manufacturing Specification MIL-S-7839

Cooper is also equipped to manufacture special aircraft fasteners, in diameters ranging up to 1½ in. For further information about standard or special Cooper fasteners, write Cooper Precision Products, 5625 West Century Boulevard, Los Angeles, California.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

STANDARD PRESSED STEEL CO.

AIRCRAFT PRODUCTS DIVISION

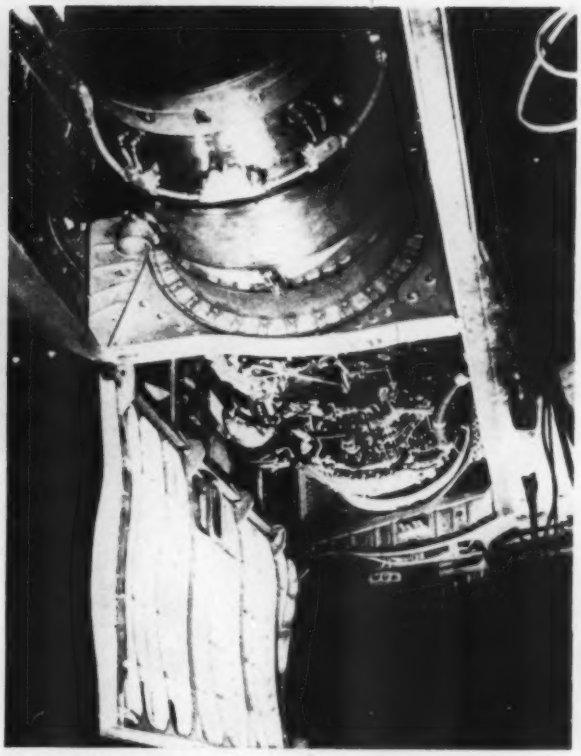
SPS

JENKINTOWN PENNSYLVANIA

Printed in U.S.A.

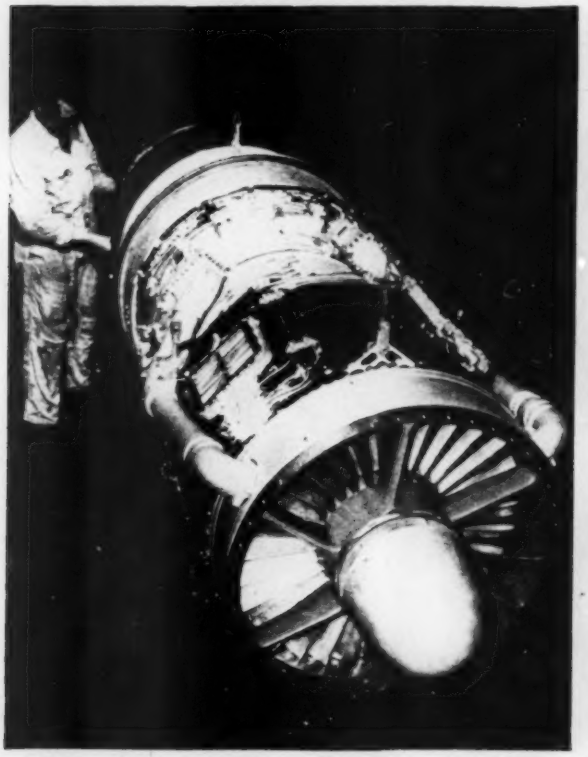
PORT AIR intakes for Rolls-Royce Avon R.A. 29 engines flank centrally-placed air scoop, upper half of which feeds cooling air to rectifier while lower half supplies air to heat exchanger for cabin air conditioning system.

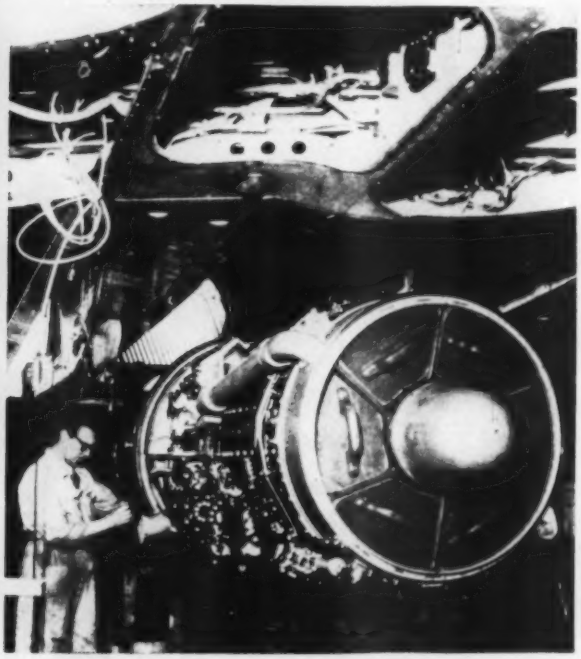
Comet 3 Engines Installed



NEW ENGINE is installed in bay of Comet 3 (below). Mounting incorporates quick release joints for all fuel and electrical connections to facilitate quick engine change. Mounting of engine tail pipe makes full provision for fitting of reverse thrust. View (above) shows accessibility of accessories, all of which are mounted below engine and can be reached from ground level. In forefront is firewall made of titanium.

SLINGING POINTS and two forward mounts are shown on engine (below). Two large pipes on either side of engine conduct hot air from rear of compressor for engine deicing purposes. Air intake support struts and variable inlet guide vanes are clearly visible.





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For example, the most powerful U. S. production turbojet, the J-75, again shows Pratt & Whitney Aircraft's ability to develop the right kind of aircraft engine at the right time. The J-75 has been selected for the newest Air Force fighters, the Navy's most advanced long-range patrol bomber, and both the Douglas DC-8 and the Boeing 707 jet airliners.

This success may be largely attributed to engineering skills and achievements. Since the beginning of the company, when the new Wasp produced the most horsepower per pound of weight, there has been no change in the reliance on these fundamentals . . . except that new talents and techniques, elaborate research facilities, and many new kinds of engineers are called for at a growing rate. At Pratt & Whitney Aircraft, nearly every field of theoretical and applied science—from nuclear physics and chemical engineering to advanced metallurgy and electronics—has a vital part to play as the science of aircraft propulsion advances.

Today, power plants of the future are being developed by Pratt & Whitney Aircraft. The Connecticut Aircraft Nuclear Engine Laboratory, for instance, will be operated by Pratt & Whitney Aircraft for the AEC and the Air Force. Whatever form the future takes . . . in new principles of propulsion, new materials or new fuels . . . Pratt & Whitney Aircraft is prepared to offer continued advancement in power plant design and production.

Pratt & Whitney Aircraft

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In Canada: Canadian Pratt & Whitney Aircraft Co., Ltd.

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Extra diligent customer service is another outstanding characteristic of Narmco's continuing efforts to provide the aircraft industry with the most advanced structural materials.

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When problems – large or small – involve the application of structural adhesives or structural laminating, you can count on Narmco for the kind of assistance that leads to a prompt solution – and better aircraft components. Extra diligent customer service from Narmco can also lead to more efficient, more economical production!

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NARMCO

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Surfaces Important To Hot Metals

Albuquerque, N. M.—Whenever metal coatings are being considered as protection for an underlying, basis metal at high temperatures, particular attention should be paid to the nature of the interface between the coating and its base.

This was one of the points emphasized by Dr. Charles L. Faust of Battelle Institute, Columbus, Ohio, at a Symposium on Heat Tolerant Metals for aerodynamic applications here.

Sound parts composed of a basis metal and protective coating can best be provided, said Dr. Faust, when the role of surface metallurgy is taken into account and when the strength and properties of any diffusion alloy formed at the coating-basic interface are known to be satisfactory.

Dr. Faust, who directs electrochemical engineering research at Battelle, reviewed the current status of knowledge on protective metal coatings for use at elevated temperatures.

He pointed out that many metals, for example molybdenum, have suitable bulk properties—tensile and creep strength, hardness, etc.—and yet will undergo surface deterioration at the temperatures reached in aerodynamic heating. (Aircraft skin temperatures may reach 600F at speeds of 2,000 mph. and possibly 1,600F at 3,300 mph.)

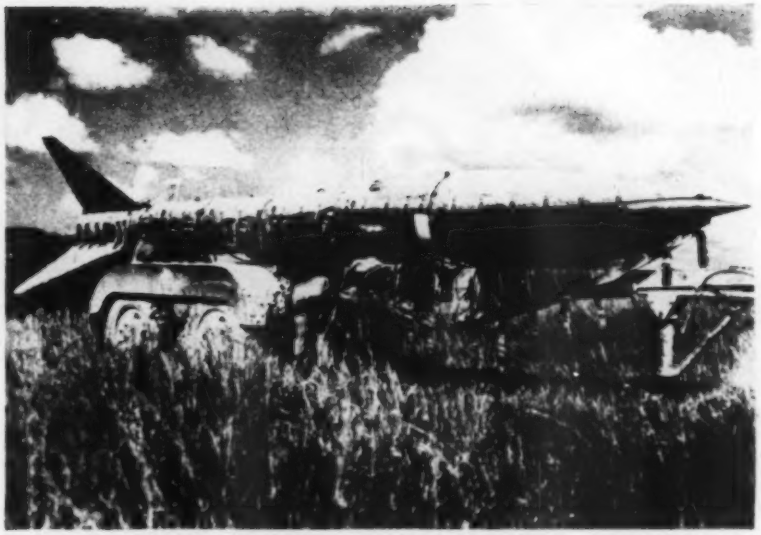
The interfacial zone between the basis metal and its protective coating can be responsible for the success or failure of the composite item. Of major importance to adherence of the coating are bond strength between the coating and the basis metal, and the preparation of the basis metal.

Preparation includes final physical and chemical cleaning and, also, the last surface finishing operations.

Instances will occur, said Dr. Faust, in which a coating and a basis metal as individuals have suitable properties but the diffusion alloy formed at the interface between them does not. In these cases, the interposition of a barrier coating with suitable diffusion characteristics can make the composite object usable.

For example, chromium and nickel-chromium alloy coatings provide inadequate protection for underlying molybdenum because the "moly" diffuses through the coatings and volatilizes on contact with the oxygen in high temperature air.

A chromium-gold-chromium barrier electroplate underneath the final protective coating, notes Dr. Faust, prevents the outward diffusion of the molybdenum.



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Contacts picked up by these DEW line (Distant Early Warning) radars are flashed to Air Defense Command centers.

The U. S. Air Force and Western Electric, contractor for the DEW line, selected Raytheon to develop radar for these critical Arctic stations. We are proud of this choice and of our opportunity, as the world's largest producer of search radar, to contribute to the protection of our hemisphere.

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Ruckstell Relocates, Expansion Planned

Azusa, Calif.—Ruckstell Corp., subsidiary of the General Tire and Rubber Co., has moved its offices and operations from East Los Angeles into a new building in Azusa.

The firm develops and manufactures permanent magnet alternators and auxiliary power units for the aircraft industry and the armed forces. Ruckstell also works on turbines and reciprocating engines for auxiliary power units. There are 35 employes at present with this number expected to be doubled in 12 months.

The new plant is located on a three-acre plot and has a working area of 16,000 sq. ft.

Strong Magnet Created by GE

General Electric researchers have created a potentially strong super magnet.

Dr. T. O. Paine, of the company's Instrument Department at Lynn, Mass., told the American Association for the Advancement of Science that the unique properties of this magnet are achieved by precisely controlling the size and shape of individual iron particles so small that there are more than a billion billion in a pound.

Dr. Paine said that, theoretically, the ultra-fine particle iron magnet can be made ten times stronger than the best available magnets. Already experimental magnets have been made equal to the strongest commercial magnets, he said.

E. E. Parker, instrument department general manager said, "The new magnet will result in electric instruments that are smaller, lighter, more accurate and more rugged, making possible significant advances in instrumentation. It will help us make better photographic exposure meters, aircraft instruments and other products using permanent magnets."

"Although it will be quite some time before the new magnets are commercially available, the door is now open to new magnet applications as significant as those that followed General Electric's introduction of Alnico—the most important permanent magnet material now in use.

"This development opens whole new vistas to the design engineer because the iron particles can be embedded in plastics, metal, rubber or glass. The magnets are easily machined, drilled, tapped, soldered, and molded precisely into any desired shape.

"Ordinary iron is used in the form of sub-microscopic elongated particles to make the new magnet. This leads to another far-reaching benefit, the saving of strategic metals like nickel and cobalt—heavily used in making most magnets.

The elimination of cobalt makes possible the application of magnets in nuclear reactors, where magnets containing cobalt cannot be used because of high induced radio-activity."

Dr. Paine said work on the development has been carried on by a small creative group in his organization. The research team started with only the speculation of theoretical physicists that ultra-fine elongated iron particles might have a high resistance to demagnetization.

But because iron particles tend to grow round, all efforts to produce elongated shapes had failed.

"The magnetic and mechanical properties of this material can be controlled precisely," Dr. Paine said. "Not only can the qualities of available magnets be duplicated, but we can achieve characteristics previously unattainable."

Ryan Buys Facilities Of Fricano Products

San Diego—Ryan Aeronautical Co., San Diego, purchased the machine tools and other equipment of Fricano Custom Products Co., Inglewood, Calif., and leased the Fricano plant and adja-

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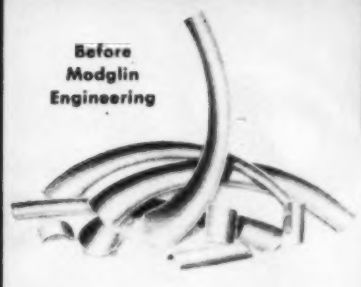

These photos show a section of the "plumbing system" for a rocket engine.

The prototype on the left was produced by MODGLIN to customer specifications. The model on the right is the final unit as improved by MODGLIN *creative engineering* suggestions.

The production unit can be produced and installed faster. It is structurally stronger, lighter, more reliable than the original. Automatic Heli-arc welding and precision machining also provide closer tolerances than initially specified.

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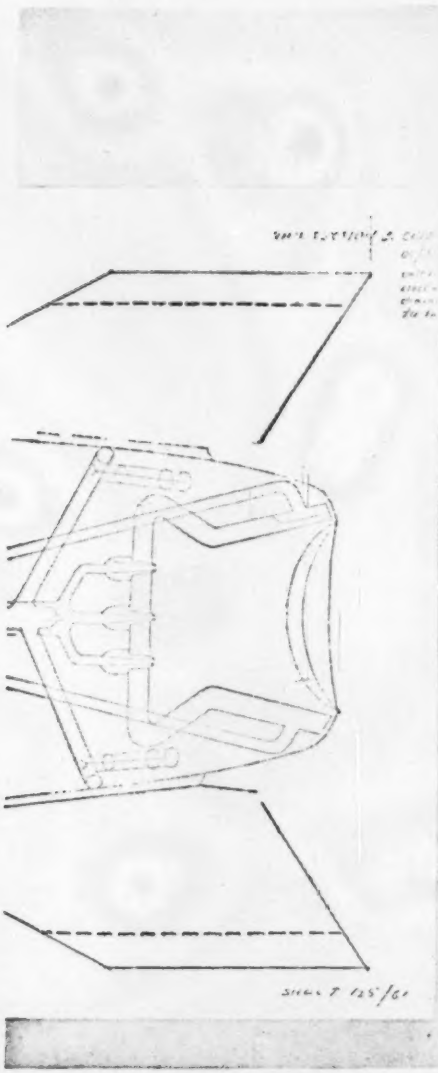

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● AMF today plays a part in more than half the missile programs under way. One of its subsidiaries, Associated Missile Products Corporation, is the only private firm devoted exclusively to missile support equipment. And AMF activities cover practically every stage of design, development, and production...including mechanical and electronic test equipment...auxiliary power supplies...field and depot handling equipment...launchers...ground and flight control systems ● See for yourself why AMF's experience in missiles, as well as in a host of other fields, has made it the "can do" company.

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cent property in Inglewood. The purchase adds 10,000 sq. ft. of floor space with highly specialized machine tools to Ryan's facilities.

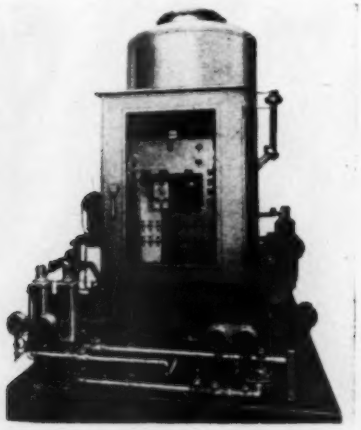
The facility will be known as Ryan's Los Angeles area office and machine shop No. 6, and will produce specialized parts for jet aircraft assemblies now in volume production at Ryan. The company has substantial contracts for power packages for Douglas DC-8 and Boeing 707 jet transports, as well as for aft fuselage sections for the KC-135 jet tanker.

Rocketdyne Consolidates Purchasing at Canoga

Los Angeles—Rocketdyne Division of North American Aviation, Inc., has consolidated its material handling and local area purchasing in a new building at the division's Canoga Park, Calif., facility. Local area purchasing for Rocketdyne formerly was handled in a Beverly Hills office. The division produces large liquid propellant rocket engines.

PRODUCTION BRIEFING

Highly purified water is produced by this ion-exchanger according to the maker, the Illinois Water Treatment Co., Rockford, Ill. The unit uses the mixed-bed principle to provide water that is free of silica and all ionizable solids with purity readings of over



1,000,000 ohms per cubic centimeter. General Electric's Gas Turbine Division, Cincinnati, Ohio, found that it had to treat the J47 water-alcohol test water with one of Illinois's units to prevent hard calcium-like deposits from forming on the turbine nozzles and buckets.

Narmco Resins and Coatings Co., Costa Mesa, Calif., reports it is undergoing a $225,000 expansion to keep up with the demand for Metalbond struc-

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WELDING PROGRESS REPORT

Thompson Products' Jet Division First in Production with New Sciaky Electronic Weld Control

The Jet Division of Thompson Products, Inc., of Cleveland, Ohio, has just released data of their first three months of actual production with the new Sciaky Predetermined Electronic Counter Controlled Resistance Welder. So far as is known, this new Sciaky welder at Thompson was the first of its kind to be put into production.

Used for Highest Specification Welding

Mr. Henry Novak, Senior Welding Engineer (Jet Division) at Thompson Products, states that he believes, *"The new Sciaky Predetermined Electronic Counter Weld Control is the most significant development in the history of resistance welding."*

"Previously, welders equipped with R-C type timer controls satisfied the requirements for fabricating parts for the 4,000 and 6,000 lb. thrust engines," commented Mr. Novak, *"but today's 10,000 lb. thrust and over engines require such extensive use of heat resistant, heat treatable metals as to put difficult demands on R-C type timer controls."*

"However, our work on a high production jet engine in the high thrust category is readily satisfied by the new Sciaky Counter Controlled Welder."

Production Based on Original Welding Schedules

Thompson Products' new Sciaky welder was qualified over a thickness range of .125 to .125 and .032 to .032 stainless steel in the 300 and 400 series as well as Nimonic. Since the welder was certified on a production job, the original schedules have never needed changing in a period of over three months and after well over 150,000 production welds.

Never a Rejection Due to Control Variation

Mr. Novak stated there has *"never been an assembly or hourly test coupon rejected due to control variation in all our experience with the Sciaky Predetermined Electronic Counter Controlled Welder."* He went on to comment about power supply, which has caused rejected assemblies. *"But, now,"* he said, *"undesirable power supply causes practically no problems because the new Sciaky Control is not noticeably affected."*

Precise Control of All Functions

The Thompson report indicates the new Sciaky control's ability to produce precisely as little as ½ cycle of heat or cool time is extremely advantageous to welding high heat resistant and corrosion resistant alloys. Its ability to actuate forging at any point during the weld cycle is critical in welding aluminum to the most rigid specifications.

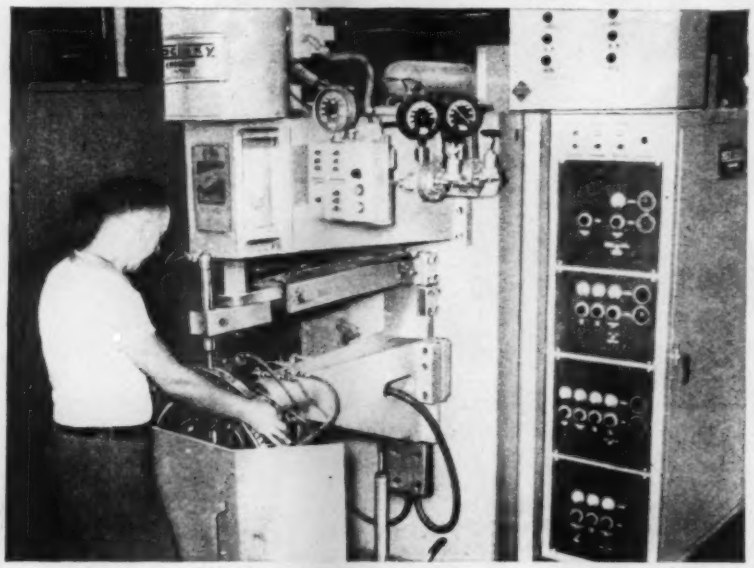
Maintenance Downtime Minimized

Thompson Products reported they anticipated no serious loss of production time due to breakdown because of the plug-in feature of all control components. Further, the interchangeability of control components will make the most complete range of control function available to any of their welders—no matter what the basic type or how originally equipped.

Literature Available

Technical bulletins completely describing the new Sciaky Predetermined Electronic Counter Weld Control are available without obligation. Write on your company letterhead requesting Bulletins 338 and 339 for complete details.

If your production is to the rigid requirements of jet engine, air frame, or Ordnance specifications, find out for yourself about the vast potential of application with this new Sciaky Control.



There *"never has been an assembly or hourly test coupon rejected due to control variation."*

Largest Manufacturers of Resistance Welding Machines in the World

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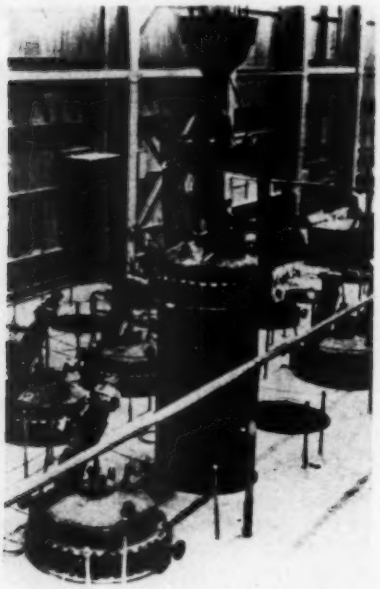
Sciaky Bros., Inc., 4935 West 67th Street, Chicago 38, Ill., Portsmouth 7-5600

tural adhesives and Conlon laminating materials. In the last 24 months, aircraft and missile requirements have increased by more than 300%, according to Narmco.

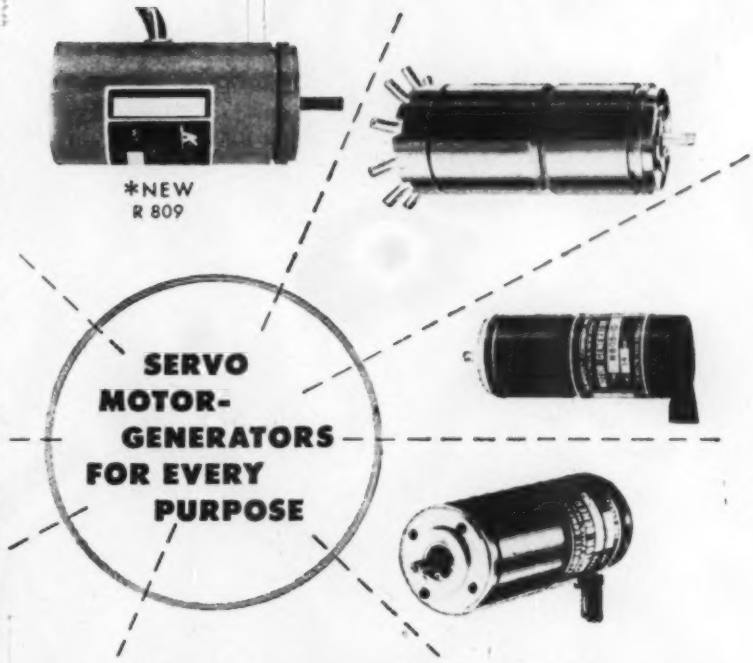
Penn Keystone Corp., West Conshohocken, Pa., bought the Keystone Division of the Riverside Metal Co. Division, H. K. Porter Co., Inc., Riverside, Conn. The Keystone Division makes position indicators for aircraft and industry.

Electro Metallurgical Co.'s new plant, Ashtabula, Ohio, is described as the nation's largest titanium sponge source. Plant is now at its full rated capacity of 7,500 tons of sponge per year. Electromet, a division of Union Carbide and



Carbon Corp., uses sodium to reduce titanium tetrachloride. In the photograph, one of the reactors, full of "spalt," the combination of salt and titanium sponge, is being lowered into a cooling station.

General Services Administration, Washington 25, D.C., which helps defense industries with critical materials, has established stockpiling units in Atlanta, Ga., Kansas City, Mo., Seattle, Wash., and Washington, D.C. The Custer, S.D., and Butte and Phillipsburg, Mont., activities which were set up to assist small businessmen by accepting small producer's deliveries of mica, beryl and columbium-tantalum at Custer and manganese at the other two Montana locations have been transferred to Denver. Other changes transfer the chromite purchase depot at Grants Pass, Ore., to the region headquarters at San Francisco, and gives inspection responsibility for purchases in Mississippi and Alabama to the Dallas, Tex., region.



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CHARACTERISTICS

TYPE	MOTOR		GENERATOR	
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DAMPING				
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SIZE 10	.30 OZ. IN.	8500	23/1	.5%
NEW R 809	.63 OZ. IN.	5900	25/1	.5%
SIZE 15	1.5 OZ. IN.	5000	25/1	.5%
SIZE 18	2.4 OZ. IN.	5000	25/1	.5%
SIZE 18	3.0 OZ. IN.	9600	23/1	.5%
RATE				
SIZE 15	.45 OZ. IN.	10,500	170/1	.5%
SIZE 15	1.5 OZ. IN.	4700	350/1	.2%
SIZE 18	2.4 OZ. IN.	4700	350/1	.2%
SIZE 18	3.0 OZ. IN.	8400	350/1	.2%
***INTEGRATOR**				
SIZE 15	.70 OZ. IN.	6300	400/1	.1%
SIZE 15	1.25 OZ. IN.	4500	400/1	.1%
SIZE 18	1.35 OZ. IN.	7200	400/1	.1%
SIZE 18	2.4 OZ. IN.	5200	333/1	.06%
SIZE 18	3.0 OZ. IN.	8000	333/1	.06%

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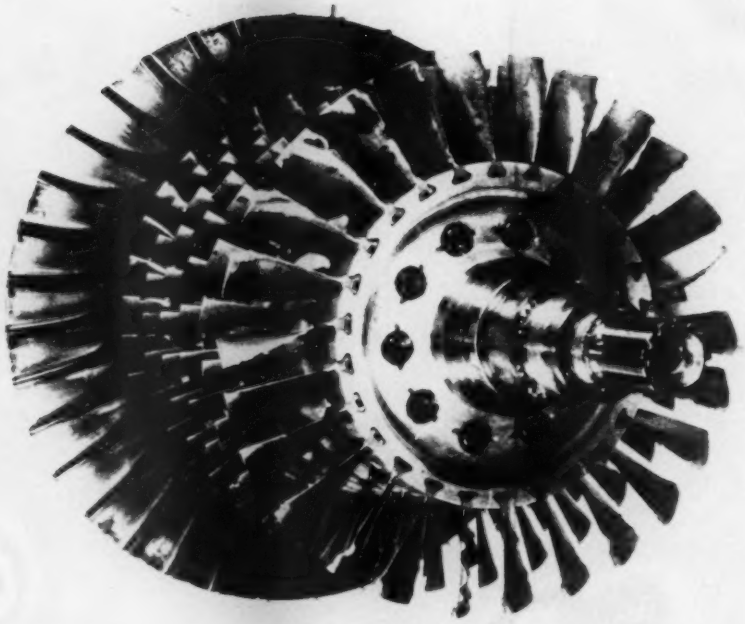

LYCOMING T53 TURBOSHAFT COMPRESSOR after swallowing a chunk of magnesium. Note that, alfhough the blades are twisted and knicked, none of them are broken. No damage can be seen on the final stage centrifugal compressor.

Advantages and Usefulness of Small Turbojet Engine Cited

A 4,000-lb. thrust turbojet is the best from the standpoint of maximum thrust per mnimum weight, two engineers from General Electric's Small Aircraft Engine Dept., Lynn, Mass., told a Society of Automotive Engineer's gathering, at the Society's recent annual meeting in Detroit. (The Small Engine Dept.'s first turbojet, the 16 in. dia. J-85, has half this optimum dry thrust value.)

Small engines down in the 50-70 lb. per second airflow range will give the best combination of thrust to weight, said D. P. Edkins and M. H. Thorson. Engines of this size will realize the maximum benefits of the two-thirds scaling law (thrust varies as two-dimensional area while weight varies as three-dimensional volume), but don't become so small that the adverse affects of very small engines take over.

Some of the adverse affects are lower compressor efficiency due to Reynolds' number (airflow scaling), relatively heavier parts because metal thicknesses and electrical accessories can not be fully scaled down.

Small turbojets will be especially attractive for supersonic flight, the G.E. engineers said. At supersonic speeds the inlet diffuser compression aid to the engine compressor will compensate for a small turbojet's inherent difficulty in achieving a high pressure ratio.

While the General Electric authors stressed high performance from special purpose small gas turbines, Lycoming's Dr. Anselm Franz said that a small gas turbine, because of its current very sizeable expense, must also be able to be rugged and useful in a variety of end uses.

A small gas turbine must be able to attract a diverse market to be economically feasible, Franz said.

In this respect some of the T53 and T55 virtues are, according to Franz:

- The compressors can absorb foreign objects without failure. One of the T53 rotors was able to swallow a magnesium chunk, 2x3x0.3 in., without breaking a single blade, though of course the blades were twisted and bent. Low hardness, good toughness in steel blading is the reason for this, Franz said.
- Besides the advantage of compactness (AVIATION WEEK, Aug. 27, p. 62) the folded-over combustor provides four layers of sheet metal to contain safely turbine explosions. When 10 buckets slid out of their fir-tree sockets on an early T55's power turbine, none of them penetrated outside.
- Because Lycoming used constant sec-

tion axial compressor stator blading, they were able to use twisted lengths of precision rolled airfoil strip. This brought the cost down to 35¢ apiece as against $10 each if machined. Similarly, an as yet experimental approach to rotor blading is expected to bring the cost down to $1.50 from $14.50 each.

• Special machinery, meanwhile, is expected to reduce the milling time for the centrifugal impeller down to a few hours from the present 65 man-hours.

• Cast turbine buckets and stator vanes in the hot end of the engine are saving 80% over conventional forged buckets.

Nearly 2,000 hours of engine running time has been accumulated on the S25 T53, Franz said. During a H40 helicopter mock-up review, it was demonstrated that the turboshaft engine could be completely removed and re-installed in 15 minutes.

Cartridge Actuates New Cutting Device

A new cartridge actuated device which can instantaneously cut through mechanical parts, hydraulic or pneumatic tubing, or many kinds of electrical cable, is being produced by Aerojet-General Corp.

Called Aerocutter, the device will sever materials which cannot be cut by any other means, according to the manufacturer.

Moreover, the device is safe, reliable, inexpensive and fast.

A typical Aerocutter, the AGX-1800, cuts four ¼ in. diameter stainless steel lines while they are pressurized to 150 psi, with corrosive fumes. Feature of the device is that, when it cuts the lines, it vents one cut end to ambient pressure while swaging the other cut end closed against an anvil to prevent further flow through the tubes. The AGX-1800 weighs less than a pound and occupies 7.5 cu. in. of space. It is fired electrically and is actuated by a non-corrosive propellant. The device may be reloaded for repeated use.

Aerocutters may be used wherever positive severance of lines or components is required. The device may be actuated mechanically instead of electrically when used in strong radio frequency fields or under low humidity conditions where electrical initiation might prove hazardous.

The devices can be supplied in single or redundant parallel firing systems.

Aerojet-General can supply a large variety of Aerocutters for military or commercial use. The company can also provide all components for the complete firing system, including sensors, firing safety devices and indicators.

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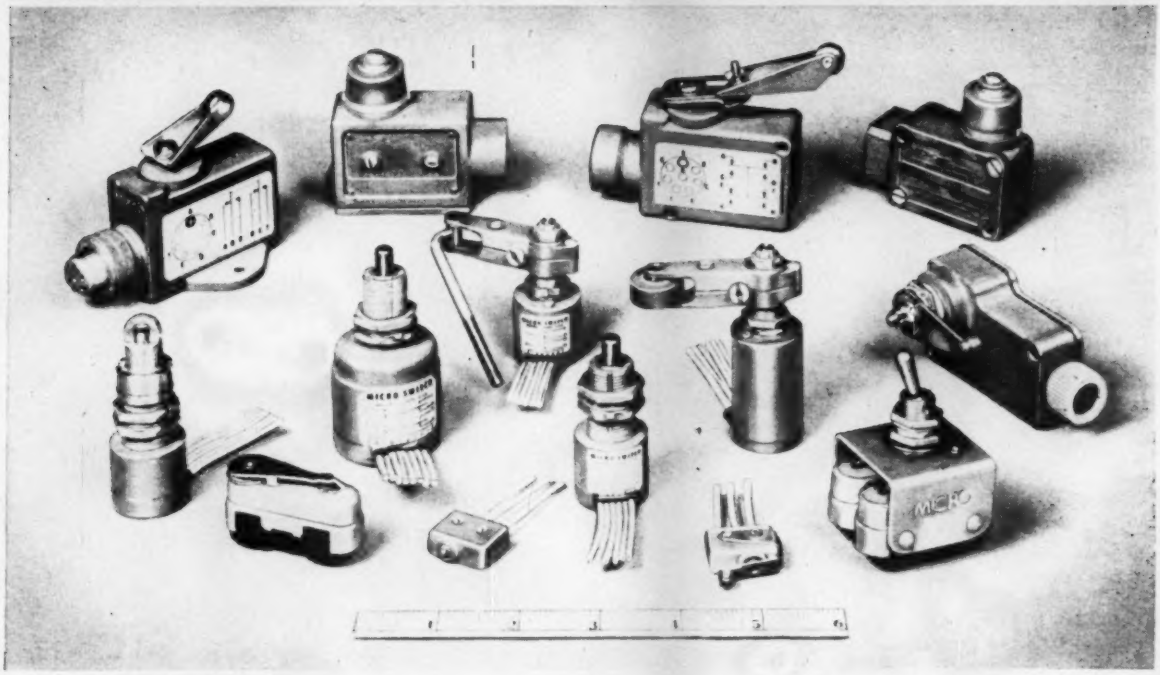

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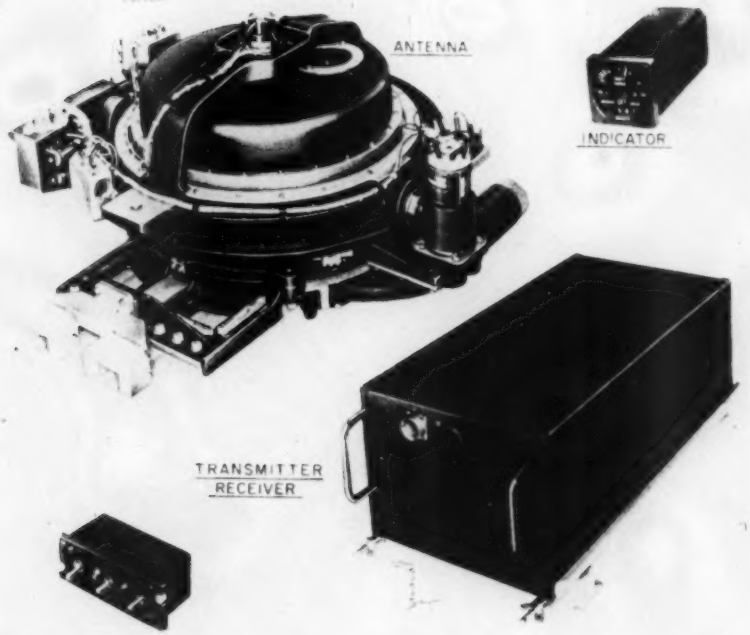


RADAN, an 85-pound Doppler radar drift-angle and ground speed indicator may find use in new jetliners. Principles of operation are shown in sketches right.

Doppler Radar Auto-Navigator Principles Described to IAS

New York—Radan, a lightweight version of General Precision Laboratory's military APN-81 automatic Doppler navigator, under consideration by several international carriers for jetliner use, is now in limited production. William J. Tull of GPL reported here last week at the annual meeting of the Institute of the Aeronautical Sciences.

The true ground speed and drift angle information provided by the 85-pound Radan is valuable for general navigation and for optimum utilization of tail winds and the jet stream. When Radan is combined with a dead reckoning computer, similar to those made by a number of companies in varying degrees of sophistication and complexity, the combination can provide the pilot with a continuous indication of his present position and/or heading-distance to destination.

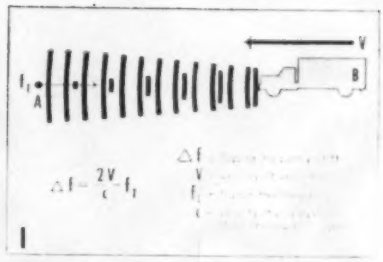
How it Works

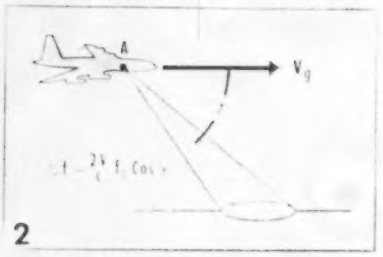
Tull presented the following explanation of the basic operating principles employed in the GPL Doppler navigator, and similar systems made by General Electric, Laboratory For Electronics, Ryan Aeronautical and Sanders Associates:

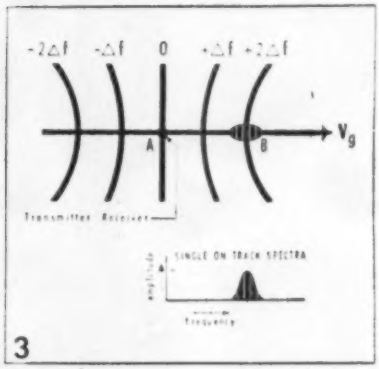
• **Fig. 1:** Radio frequency signal transmitted from point (A) at frequency (f_t) is reflected from moving target (B). The reflected energy, received at point (A) has a slightly different frequency from that originally transmitted. This change, or Doppler frequency shift, (Δf) is directly proportional to the vehicle's velocity and the transmitted frequency. If the latter is held constant; then the Doppler shift is a direct measure of vehicle velocity.

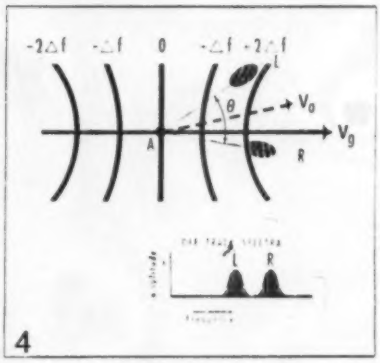
• **Fig. 2:** When transmitter and receiver are located in a moving vehicle, such as an airplane or missile, and directed toward the ground, the Doppler shift (Δf) is proportional to the vehicle's velocity relative to the ground and the cosine of the angle between the radar beam and the horizontal (γ). If airplane velocity is constant, the Doppler shift becomes a direct function of the cosine of the angle between the radar beam and the ground.

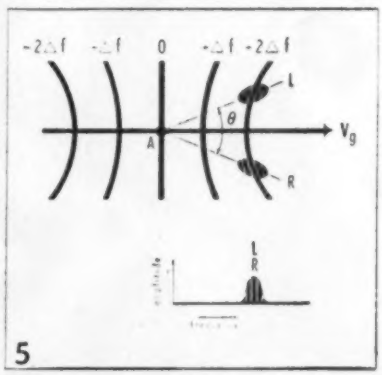
• **Fig. 3:** If contours of equal Doppler frequency shift are drawn, representing a constant angle of intersection between beam and the ground (assuming a plane earth), the result is a family of hyperbolic shaped curves, as shown for an airplane at point (A). The lines ahead



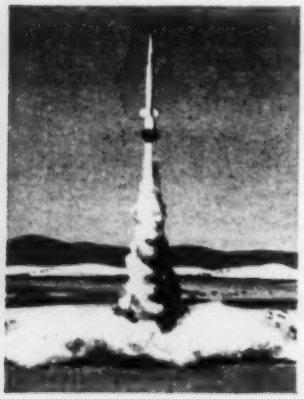








The International Geophysical Year is a period of intensive research devoted to the earth and its surroundings. Aerojet-General research rockets will play a major role in IGY. In addition to Project Vanguard propulsion systems, Aerojet will supply its famed Aerobee-Hi rockets for critical research flights from Hudson Bay.



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of the airplane represent a positive frequency shift where the received frequency is greater than that transmitted; the lines behind represent a negative shift where the received frequency is less.

The line at right angles to the airplane's velocity vector (V_g) represents the zero Doppler shift condition where the radar beam is aimed directly down or broadside where there is no relative motion between radar beam and ground, assuming a smooth surface.

The previous discussion has considered the radar beam as if it were infinitely small in dimensions. In practice the intersection of even a small pencil beam with the ground produces an elliptical shaped area (B) all of which reflects signals back to the receiver. The energy reflected from one end of the elliptical area nearest the aircraft will have a slightly smaller Doppler shift than that reflected from the other end. If the intensity of the received Doppler shift signal is plotted as a function of its frequency distribution, it would appear as shown.

• **Fig. 4:** If two identical radar beams are used instead of one, separated by an azimuth angle (θ), then the beam (R) which is pointed more nearly in the direction in which the airplane is moving relative to the ground (V_g) will sense a higher velocity and produce a larger Doppler shift than will the other beam (L) which "sees" less relative motion with respect to the ground.

• **Fig. 5:** If the dual beam antennas are mounted on a motor-driven support and rotated in azimuth, when the two beams are so oriented that they produce equal Doppler frequencies a line which bisects the angle (θ) between them corresponds to the direction of airplane movement relative to the ground. If a servo system is used to drive the antennas until their Doppler shifts are equal, then the angle between the airplane centerline and the centerline between the two antennas corresponds to the drift angle, while the Doppler shift is proportional to true airplane ground speed. Drift angle can also be obtained with a fixed two-beam system by computation instead of driving the antennas to a balanced (null) condition, Tull pointed out.

Automatic Navigation

The true ground speed and drift angle information available from Radan can be used to eliminate the most serious error in dead reckoning computers which arises when the pilot must manually set in estimated wind velocity and direction. The dead reckoning computer without Doppler radar input must compute ground speed from the set-in wind velocity and direction and from indicated or true airspeed.

Depending upon the degree of sophistication designed into the DR computer, the combination Doppler radar-computer can give the pilot several or all of the following:

• **Present position** (latitude and longitude).
• **Drift angle**
• **True heading and magnetic variation**
• **Direction and distance to destination**
• **Autopilot tie-in** to automatically steer the airplane to the destination.

Present indications are that the Doppler auto-navigators which the overseas airlines will purchase in the coming months will have some, but not all of these features.

FILTER CENTER

► **BTL Plans Nuclear Test Facility**—Bell Telephone Laboratories will build a nuclear reactor at its Whippany, N. J. facility, under Air Force sponsorship, to study effects of nuclear radiation on electronic components and materials. Construction is slated to begin this year. Facility will use a heavy water moderated heterogenous fuel reactor, similar to one developed originally by Argonne National Laboratory.

► **SSB Bibliography**—Naval Research Laboratory has prepared bibliography of all material published on single sideband between 1921 and July 1956. The 105-page volume, identified PB 111837 "Single Sidebands in Communication Systems, A Bibliography" by M. Benton, is available for $2.75 from Office of Technical Services, Dept. of Commerce, Washington 25, D. C.

► **VHF Transistor Prices Slashed**—Texas Instruments has cut prices of its very high frequency transistors by 50%. The units are grown-diffused types capable of oscillating at frequencies beyond 250 mc. Company also cut quantity prices of its silicon transistors and rectifiers by 10%.

► **Auto-Navigator Gets Army Check-out**—Army Electronic Proving Ground, Ft. Huachuca, Ariz. is flight testing new self-contained Doppler automatic navigator, developed by Ryan Aeronautical. Company is producer of similar AN/APN-67 auto-navigator for Navy Bureau of Aeronautics.

► **New IRE Affiliate Membership**—Institute of Radio Engineers has adopted new plan which will enable qualified non-IRE members to become affiliated with certain of its Professional Groups without first joining IRE. New Affiliate Plan is expected to prove beneficial for certain groups, such as the one on Medical Electronics, which can now

Globe Aerostatique . . . 1783

Montgolfier's vanguard project

A sheep, a duck, a rooster—the first payload carried aloft for atmospheric research. Louis XVI, his queen and his court, were astonished witnesses as Joseph Montgolfier's smoke-filled balloon rose in majesty 1500 feet over Versailles. The passengers? unharmed (except the rooster, kicked by the sheep).

Project Vanguard, 1957, is an equally momentous "first"—an attempt to place a 21-pound satellite in an orbit 300 miles up. Aerojet-General, designer-builder of the famed Aerobee-Hi, will supply vital second-stage propulsion systems for Vanguard launchings during the International Geophysical Year.

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The design of Gerotor pumps combines a number of valuable advantages to aircraft engineers, among which are exceptional mechanical and volumetric efficiencies.

▶ **The Gerotor** is basically a form of internal gear pump. It has only two moving parts – an *inner* toothed element which meshes with an *outer* toothed element. The inner has one less tooth than the outer and this "missing tooth" provides a chamber to move fluid from the intake to discharge port. (See Figure 1).

Both Gerotor elements turn in the same direction – and either one may be driven. The difference in number of teeth results in a slow relative rotation between the Gerotors as they turn, gradually opening the chamber as it passes the intake port, allowing fluid to enter, slowly closing as it passes the discharge port, forcing the liquid out. The fluid-tight engagement of the two elements, the resultant *continuous contact* of each inner Gerotor tooth with the outer, provide high suction, high pressure, and high volumetric efficiency.

FIG. 1

The rate of change of the tooth chambers is at a maximum halfway across the ports; at a minimum at the instant of change-over from one port to the other and tapers smoothly in between. *Hence porting is not critical and there are no violent pressure changes.* This is particularly valuable at high altitudes where rapid pressure changes and excessive turbulence engenders foaming and lowered efficiency in other types of pumps.

▶ **With only two** moving parts, with slow relative rotation between them, a single shaft and closely maintained clearances, mechanical efficiency remains high over a long service life.

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accept medical doctors and biologists. Participation in the plan is optional with each Professional Group and the affiliate member must belong to an accredited organization approved by the Professional Group and the IRE Executive Committee.

▶ **Global Flight Uses SSB**—Network of 10 ground stations equipped with Collins single sideband equipment enabled Strategic Air Command to maintain continuous voice contact with its globe circling B-52s on recent record hop. In telegram of commendation to Collins, Gen. Curtis E. LeMay said: "We have progressed a long way toward ultimate goal of 100% reliable air-to-air and air to ground communications."

▶ **ATC Transponder Evaluation**—Delta Air Lines and Braniff have ordered service test quantities of Collins Radio's new Model 621A-1 air traffic control transponder for use in Civil Aeronautics Administration's evaluation program to get under way next year.

▶ **Computer Designs Transistor Circuits**—University of Illinois's digital computer laboratory has developed techniques for using digital computer to design transistor flip-flop circuits for new computers, under Office of Naval Research sponsorship. Digital computer circuits require that a large number of tolerance conditions be met simultaneously. University has developed simultaneous non-linear algebraic equations describing these conditions which can be solved by digital computer. For further details, write Gene H. Leichner, University of Illinois, Digital Computer Laboratory, Champaign, Ill.

▶ **New Business**—New orders recently announced by avionics manufacturers include:

• **General Precision Laboratory,** $17 million from USAF's Air Materiel Command for additional quantities of the AN/APN-81 and APN-89 Doppler navigation systems.

• **Ford Instrument Co.,** $15 million from Air Materiel Command for production of AN/ASN-7 dead reckoning navigation system.

• **Collins Radio Co.,** $9.9 million from AMC for UHF ground-communications equipment, including 1,500 AN/GRC-27 sets. Collins also received $19.5 million Navy Bureau of Aeronautics contract for 2,500 AN/ARC-38 HF transceivers, 1,100 AN/ARR-41 receivers, antenna couplers, test equipment and accessories.

• **Consolidated Diesel Electric Corp.,** $1 million contract from Civil Aeronautics Administration for power units to provide standby power for CAA radars in the event of loss of regular commercial power.

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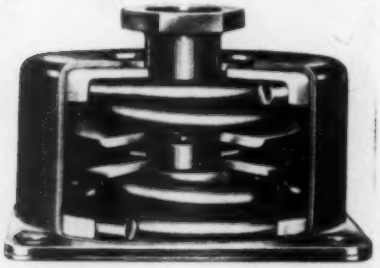
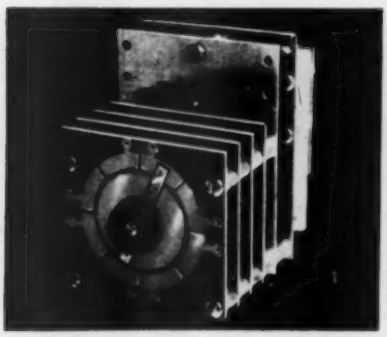


nance below a value of three. Mount reportedly shows negligible change in performance over temperature range of −56C to 120C. Barry Controls Inc., 815 Pleasant St., Watertown 72, Mass.

• **Miniature sequence timer,** Model AGC, weighs 3½-4½ oz., measures 2¼x1¾x1¾ to 2⅝ in. deep, depending upon number of printed circuit decks. Units can be supplied with 1 to 4 decks



each with 2 to 8 contacts. Use of printed circuit plates makes possible quick delivery of special commutator time sequence arrangements to customer requirements. Brailsford & Co., Inc., 670 Milton Road, Rye, N. Y.

• **Sub-miniature precision wire-wound potentiometer** with jewel bearing requires only 0.01 oz.-in. torque, measures ½ in. dia., weighs ¼ oz., comes in resistances of 10 to 250,000 ohms with linearity of 0.3%, rated 2 watts for 60C rise. Operating temperature range is −55C to 150C. Ace Electronics Associates, Inc., 103 Dover St., Somerville 44, Mass.

• **High temperature capacitor** with low dielectric absorption, operates at temperatures up to 200C without derating, has power factor less than 0.0005 and "Q" above 2,000. Standard units have insulation resistance greater than 10^6 at 200C, more than 10^{10} at room temperature. Units are available in sizes from 0.001 to 2 mfd., 150 to 4,000 volts d.c., with tolerances of 1-10 percent. Balco Research Laboratories, 49-55 Edison Place, Newark, N. J.

Microwave Devices

• **EHF microwave generators,** a new line covering band from 18 to 50 kmc. utilizing interchangeable tuning units, are now available from Polarad Electronics Corp., 43-20 34th St., Long Island City 1, N. Y.

• **X-band klystron,** Model VA-806, provides 2,000 watts continuous power in the 7,125 to 8,500 mc. range, with

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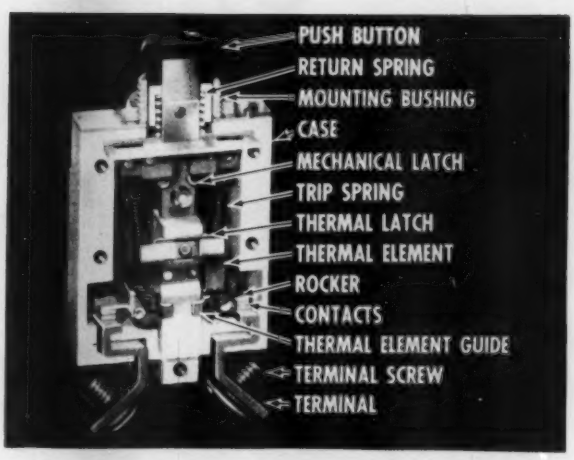
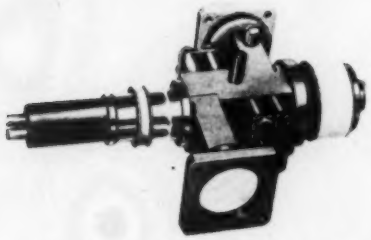


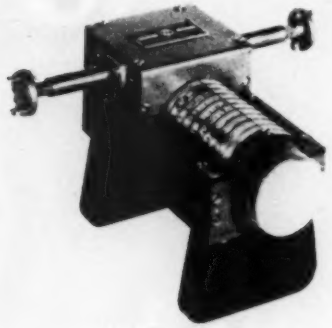
Write for detailed Spec Sheet No. AW-2

MECHANICAL PRODUCTS, INC. • JACKSON, MICHIGAN



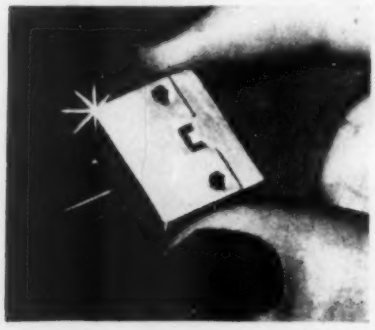
power gains of approximately 50 db. for frequency, amplitude or phase modulated input signals. Tube is water cooled, has four cavity cascade amplifier that can be tuned to within 25 mc of specified center frequency. Complete specs and data are available from Varian Associates, Applications Engineering Dept., Palo Alto, Calif.

• Direct-reading attenuator, Type M164A, covers range of 50 to 75 kmc., for use in RG-98 u type waveguide. The unit can be calibrated to 50 db., with maximum calibration error of 0.1



db. or 2% of reading whichever is greater. Transmission loss is less than 1 db. and not included in calibration. UR Machine Works, Inc., Electronics & X-Ray Div., 26-12 Borough Place, Woodside 77, N. Y.

• Broadband millimeter waveguide crystal, for mixer or low-level video detector use in the 26.5 to 75 kmc. range, measures ⅜x¼x½ in. Crystal case is silver plated brass and forms a section of



a ridged waveguide with crystal as an integral part. Microwave Associates, Inc., 22 Cummington St., Boston 15, Mass.

Instrumentation

• Portable transistor tester, Model KT-1, measures beta, h_{fe} and I_{co}. Unit is self contained and battery operated. It

measures 5¾x5¼x10 and weighs 3 lb. Baird-Atomic, Inc., 33 University Road, Cambridge 38, Mass.

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What happens to metals at 25,000 m.p.h. 200 miles up?

General Mills scientists are finding some of the answers to this question, which bears directly on space ships and man-made satellites.

Their findings indicate that materials to be sent into space must possess properties not found in today's ores and alloys. Since few new metals remain to be discovered, they conclude that present ones must be given new properties to cope with the heat barrier and to keep vehicles from disintegrating under particle bombardment.

The study of metals in space flight represents but a single phase of General Mills' over-all program of advanced exploration in theoretical and developmental physics.

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Silicone Rubber Is Electrically Conductive

A new development in silicone rubbers (AW Jan. 14, p. 82)—electrically conductive compounds—has just been made available in production quantities by the Silicone division, Union Carbide and Carbon Company.

The manufacturer says that "the new elastomers are highly unusual in that they retain their conductivity with little change after both repeated flexing over 100,000 cycles, and while under considerable stress—even at 200% elongation—to the point of being the best yet seen in reported values on elastomeric materials."

Called Union Carbide X-1516, the new, conductive silicone rubber enjoys all the usual advantages common to non-conductive, silicone rubbers—resistance to high and low temperatures (the new compound's temperature limits under continuous exposure are −80F to +400F), weathering, corona, ozone and having the quality of being generally inert.

By contrast, conductive organic rubber has approximate temperature limitations—depending on the particular compound—of about 0F to +250F, and its resistivity can change radically under manufacturing operations or with any appreciable amount of flexing.

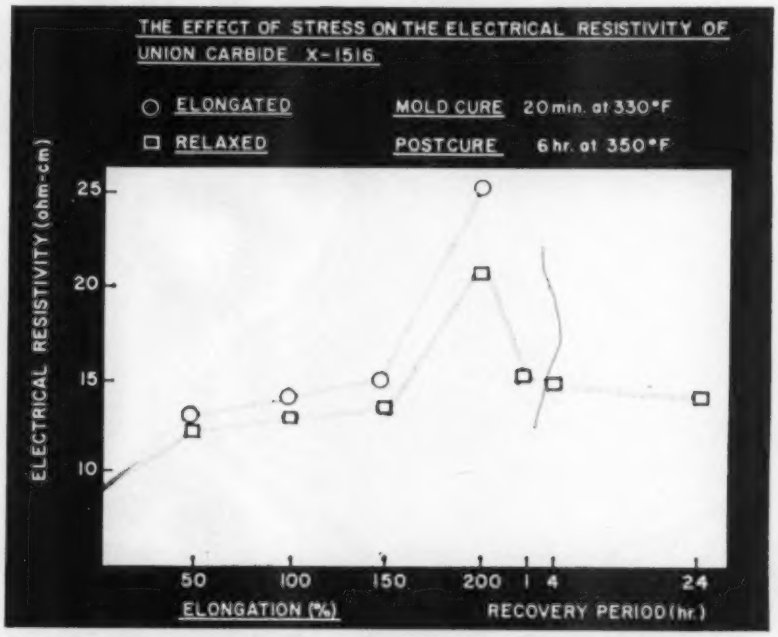
Aviation Applications

A Union Carbide spokesman told AVIATION WEEK that X-1516 is currently attracting more industry interest than any of its other silicone rubber products.

He said that the Royal Canadian Air Force is currently testing X-1516 as both a thermal wing de-icer and as material for camera warming blankets. In the latter application, the conductive silico rubber is laminated between two sheets of general purpose, non-conductive silicone rubber, such as Dow Corning K-1035, to provide electrical insulation for the conductive X-1516. The heating blanket is shaped to conform generally with the shape of the camera to be heated to provide a close, and therefore efficient, fit.

Union Carbide said that U. S. airframe manufacturers have also expressed interest in X-1516. Among them is Chance Vought, which is interested in possible use of the material in a tooling program for manufacturing aircraft assemblies by adhesive bonding rather than by conventional riveting.

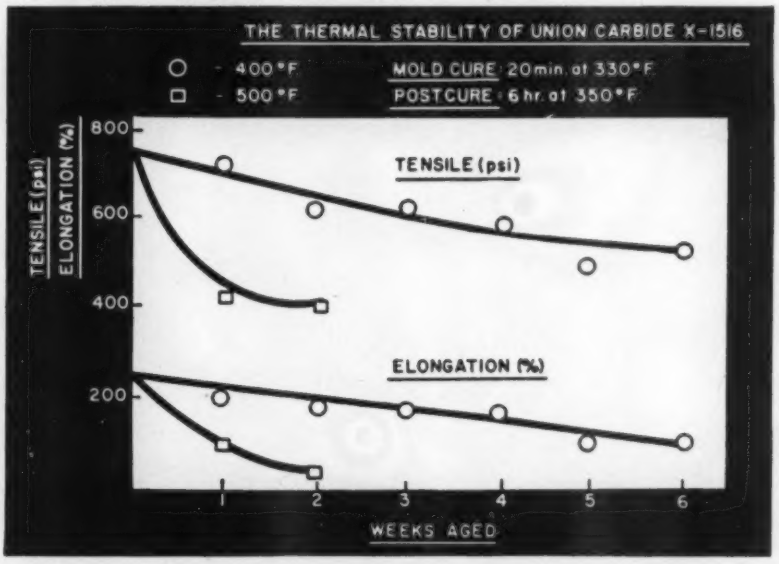
The flexible rubber heating blankets would be used to set the adhesive bond while under pressure. Use of silicone



Effect of Flexing on the Electrical Resistivity of Union Carbide X-1516*

No. of flex cycles	Original Resistance	Electrical Resistivity (ohm cm.) 1 min. after flexing	1 hr. after flexing	24 hr. after flexing
0	10	...	...	...
100	...	16	13	13
1,000	...	13	12	11
10,000	...	14	13	12
100,000	...	16	14	13

* Mold cure: 20 min at 330 F; Postcure: 6 hr. at 350 F



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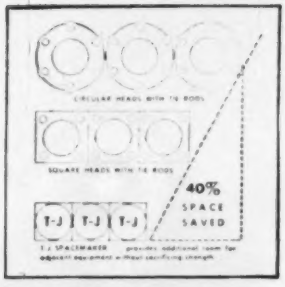

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rubber allows the blankets to be heated as high as 400F for indefinite periods and to 450F intermittantly.

X-1516 Conductivity

The company says that Fairchild and Convair are also interested in X-1516 for unspecified uses.

Conductivity of X-1516 is achieved through the use of carbon black as a filler. The degree of conductivity in silicone rubber can be varied by the type and amount of carbon black used.

Union Carbide points out that "while any black will produce a conductive silicone elastomer, acetylene black has the most desirable combination of properties for the practical preparation of conductive silicone rubbers. Acetylene black's extremely high electrical conductivity coupled with its compounding versatility make its use highly desirable."

Addition of Silica

It is possible to use a mixed silica-carbon black filler to control the electrical conductivity or processing properties of conductive silicone rubber stocks. If small amounts of silica are added to an acetylene black filled stock, the extrudability and calenderability of the rubber is improved.

Addition of silica also increases the tensile strength and hardness of silicone rubber and decreases its elongation. And, since the silica's effect on resistivity is small, its addition provides a convenient means of producing an entire hardness family of conductive rubbers.

Price of Union Carbide's X-1516 ranges from $4 to $3.60 a pound, depending on the quantity produced.

Boeing Recovery Closes B-52 Production Gap

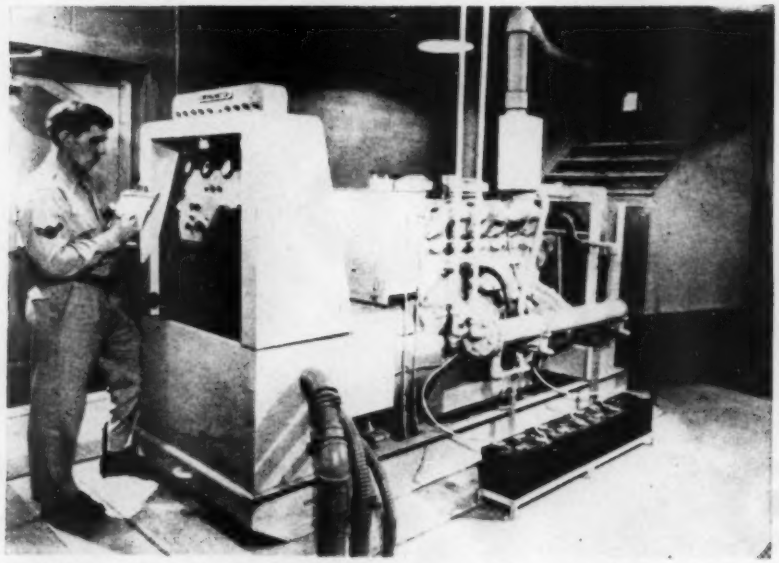
Boeing Airplane Co., through intensive schedule recovery program, is within two airplanes of its master B-52 delivery schedule.

Alternator-pack difficulties, fuel system rework, engineering changes to increase performance, new sealing procedure on fuel cavities caused slip in schedule.

Recovery program, with target of reaching within nine planes of master schedule exceeded this goal by seven airplanes.

Boeing YC-97Js Complete MATS Logistical Tests

Two Boeing YC-97J aircraft powered by Pratt & Whitney T34 turboprop engines were transferred to another command after completion of tests by Military Air Transport Service of turboprop aircraft as logistical carriers. MATS reported satisfaction with the performance of the aircraft.



AIRMAN CHECKS Automatic, dual diesel powerplant manufactured by Consolidated Diesel Electric Corp. for radar stations in case of commercial power failures.

Con Diesel Develops Automatic Standby Power for Radar Stations

A completely automatic, dual diesel standby powerplant to supply electric current to gap-filler radar stations in case of commercial power failure are being delivered to the Department of Defense by Consolidated Diesel Electric.

(Gap-filler radar stations are installations which cover gaps between main and auxiliary radar stations because of uneven terrain or other reasons).

Labeled Model 4000, the compactly-packaged powerplant will be used for 80% of all gap-filler radar installations in the U.S., according to Con Diesel.

Automatic Check

Here is what the automatic powerplants will do:

- **Fluctuation** or failure of commercial power triggers the Model 4000 to disconnect the incoming commercial power. Then both of its diesels start simultaneously. Full electrical load will be supplied in 12 sec. or less.
- **First diesel** to reach full power output signals the second unit which turns itself off and returns to standby condition.
- **Automatic check** of the commercial power supply voltage after the voltage has returned to the correct range is provided. If commercial power remains within correct limits, the unit switches the radar station to commercial power, shuts itself off, and the operating diesel returns to standby condition.

The unit also sends signals concerning its own operating conditions to technicians at control centers miles away. If one of the diesels fails to put out sufficient power because of lubrication or other malfunction, it turns itself off and signals to the main control station the fact that it has failed and the reason why.

A memory system, which records control or mechanical deficiencies in the units, indicates to control station technicians what repairs are necessary and what parts need adjustment or replacement.

As the failing unit shuts itself down, it signals to the standby diesel to start up and take over the load.

Awarded Contract

The company has also been awarded a $1-million contract for similar automatic electric generator sets by the Civil Aeronautics Administration. The power units will be used to supply current to GCA systems in case of commercial power failure. First shipments will be made in April.

Con Diesel's automatic power equipment in the Continental Radar System plays a large part in the operation of SAGE, the Semi-Automatic Ground Environment System, according to the manufacturer.

The company says that, within the last 18 months, it has received orders for over $6-million worth of special generator sets to support advanced electronic equipment.

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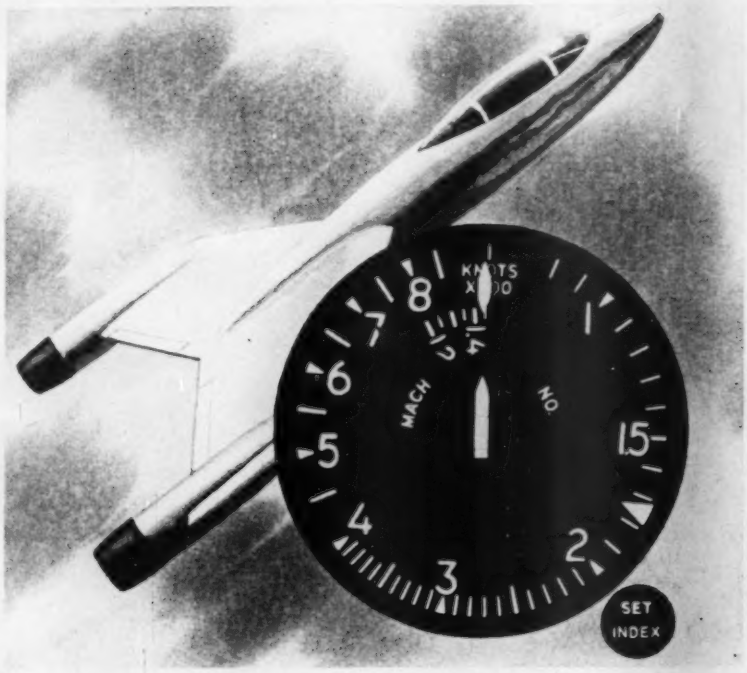

BENDIX MACH-AIRSPEED INDICATOR COMPUTES:

$$M = \frac{V_t}{C_s} = \frac{\text{true airspeed}}{\text{speed of sound}} \qquad V_e = V_t \sqrt{\frac{\rho}{\rho_o}}$$

$$V_c = C_s \sqrt{5\left[\left(\frac{\Delta P}{P_o} + 1\right)^{\frac{2}{7}} - 1\right]} \qquad \frac{\Delta P}{P_o} = K\left\{\frac{\left(\frac{V_c}{C_s}\right)^7}{\left[7\left(\frac{V_c}{C_s}\right)^2 - 1\right]^{\frac{5}{2}}}\right\} - 1$$

Bendix Pioneering developed the first instrument to compute both Mach and airspeed—the forerunner of the modern Mach-airspeed indicator.

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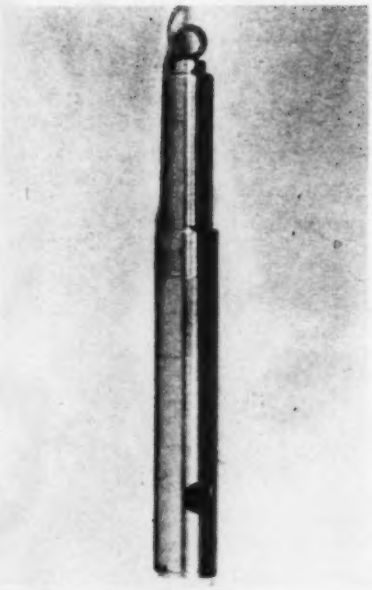

Reefing Line Cutter For Cargo Chutes

This new cartridge actuated device is a light-weight, variable time-delay parachute reefing line cutter to be used with large cargo-type 'chutes. (A reefing line, laced around the bottom of a cargo 'chute's skirt, is needed to keep the canopy's opening to about 25% of its normal opening speed to prevent ripping). After the canopy opens, the reefing line must be cut. This is accomplished by attaching a shortened shroud line to the cutter's sear.

As soon as the sear is pulled, a spring-loaded firing pin initiates a primer and, in turn, a pyrotechnic delay element which can be controlled for a 0-10 sec. delay. When it has burned through, the element initiates the main charge which forces a cutting edge forward to sever the reefing line which has been threaded through cutter. Device can handle nylon rope to ¾ in. in diameter.

The cutter is 6 in. long, ¾ in. in diameter, and weighs 3 oz. compared to 1.2 lb. for similar currently-used cartridge actuated devices. The unit may be reused, and the time delay may be varied after each use as desired.

Manufacturer: The Lake Engineering Co., Hamden, Conn.

Amalgamated Wireless Becomes Napier Agent

Amalgamated Wireless Ltd. will be Australian agent for D. Napier & Son Ltd. Agreement covers turbine engines, rocket engines and all other Napier aviation products except Spraymat anti-ice heating system, for which separate, broader agreement is being negotiated.

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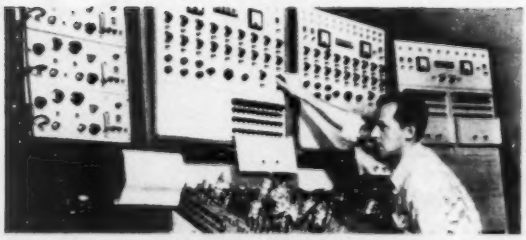
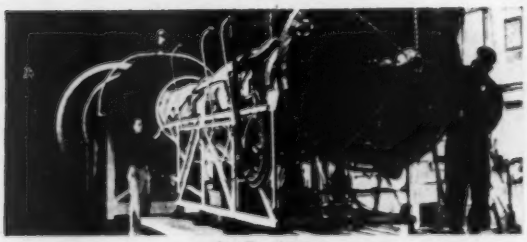


Electronics Systems



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MARTIN'S TM-61 Matador poised for launching on a Union Switch & Signal transport trailer. Two ball-and-sockets support front of the missile. The rear support is a bolt which restrains the missile until full power is attained.

Mobile System Developed for Matador

By George L. Christian

A new, all-terrain mobile ground support system has been developed for the TM-61B Matador (AW Jan. 28, p. 30), Glenn L. Martin Company's latest version of the surface-to-surface tactical guided missile.

Self-Sufficient

The completely self-sufficient ground support system is made up of two vehicles—a multi-purpose prime mover called the MM-1 Teracruzer, and a Matador-carrying semi-trailer, the Trans-Launcher which sends the missile on its mission.

Key to the truck-trailer's ability to blaze its own trail over terrain impassable to standard military trucks is the barrel-like, low pressure pillow tires on which both tractor and trailer ride.

Four companies are cooperating in this phase of the USAF's Matador weapons system program.

The Martin Company builds the missile and is the prime weapons system contractor.

The Teracruzer was engineered and built by Four Wheel Drive Auto Company.

The Translauncher semi-trailer is part of a new ground support system developed by Goodyear Aircraft Corp. for use in launching the Matador missile.

Goodyear Aircraft built the prototype trailer, has sub-contracted production units to Fruehauf Trailer Company's Missile Products Division.

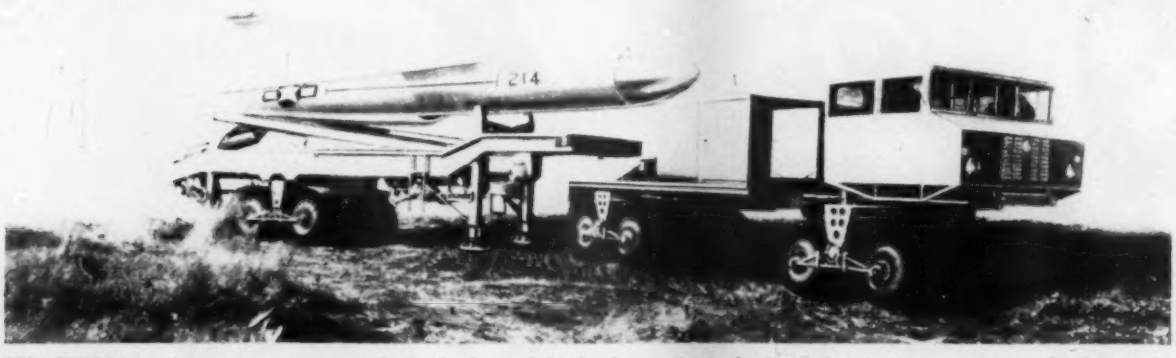
The tubeless, bag-like Terra-Tires were designed and manufactured by the Aviation Products Division, Goodyear Tire and Rubber Co.

Tubeless Terra-Tires

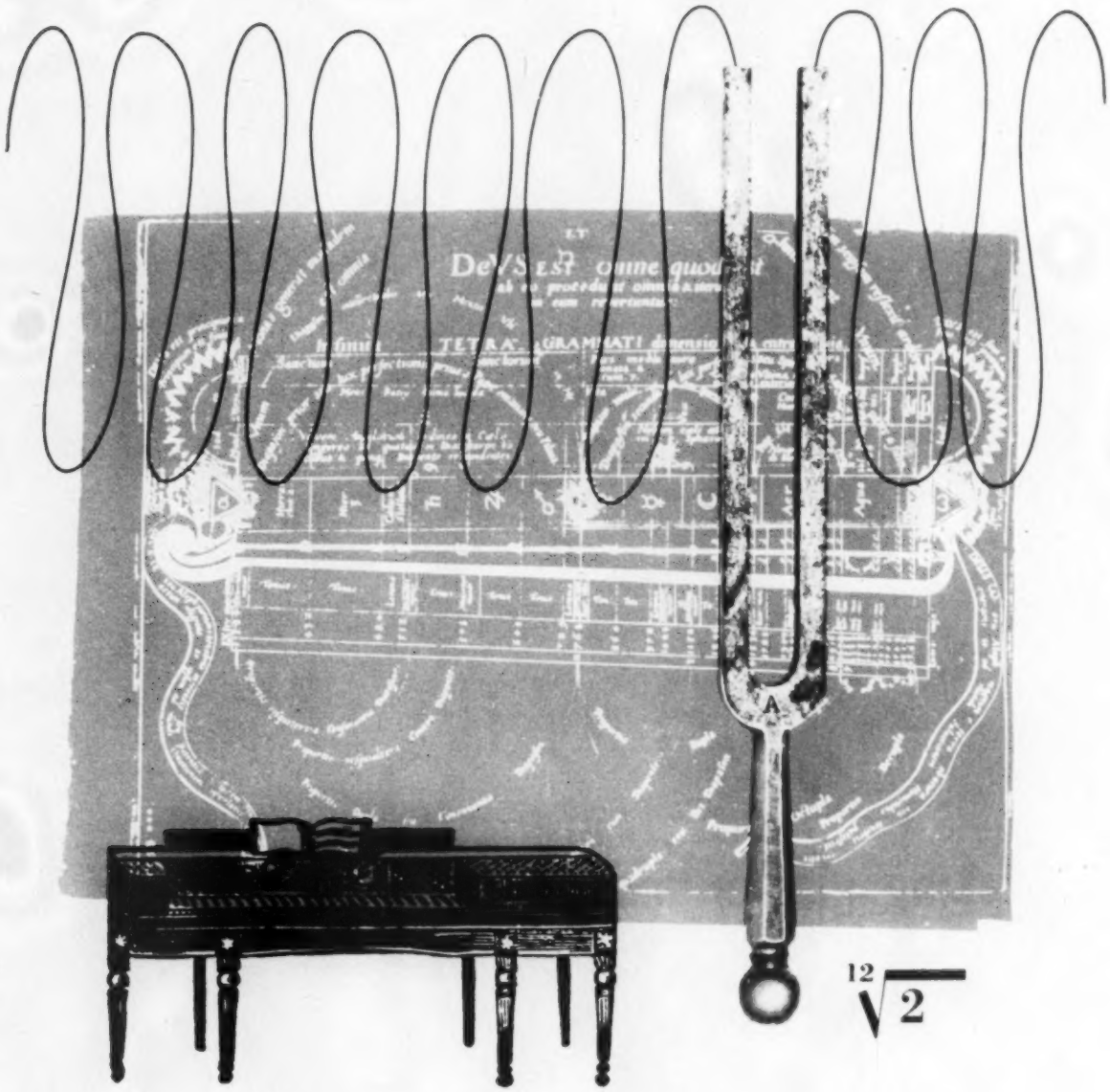
Twelve Terra-Tires are used on the tractor-trailer, eight on the Teracruzer and four on the Translauncher. Each huge tire is 5¼ ft. long and 3½ ft. in diameter. Air pressure varies from 3 to 15 psi.

Terra-Tire features include:

• **Pressure** in each tire may be con-



TERACRUZER'S eight terra-tires are powered. Steel cabinets behind cab contain food, electrical maintenance, service and other equipment. Translauncher carries and launches missile.



The Formula That Revolutionized Music

MATHEMATICIANS long ago divided an octave into 12 equal semitones, each a successive power of the twelfth root of 2. This "equal temperament" formula was the key to a new world of music that could be created for much-simplified instruments. We like this example of one of the Arts benefiting from one of the Sciences—and of mankind benefiting from both. The example contains the mightiest of the Sciences, a new world of thought, creativeness, and refinement of design. These elements exemplify the work of Litton Industries in advanced electronics.

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PLANE FAX

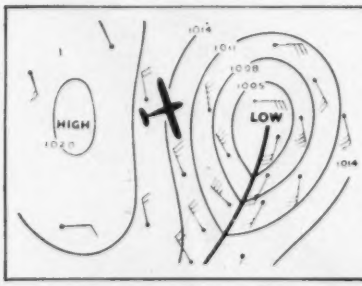
by STANDARD OIL COMPANY OF CALIFORNIA

Taking glacier "portraits" at 10,000 feet

Skimming over the Cascades far above timberline, photographer Hugh Ackroyd and pilot John Inman flew into every ice-clogged canyon from Mount Rainier south to the Three Sisters. Often skirting within 50 feet of the jagged surface, they completed a photographic survey of the range's shrinking glaciers in one day.

A veteran pilot himself, Mr. Ackroyd says "I can fly from Portland to any job anywhere in hours, and I often do. Sometimes it calls for flying as rugged as our glacier trip, but Chevron Aviation Gasoline always gives me the extra push I need whenever I need it. Chevron never fouls plugs, either — keeps the engine running smoothly under the toughest flying conditions."

Back at his home airport of Hillsboro, near Portland, John Inman says "I'm an A & E, and I've seen RPM Aviation Oil end my trouble with sticking valves and rings. When I open up an engine I can tell if it's been run on 'RPM' — it keeps parts so clean it almost doubles engine life."



TIP OF THE MONTH

It's wise to remember that your altimeter will read more altitude than you actually have when you fly from a high to a low pressure area, *and* when you head into colder air.

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rolled by the Teracruzer driver to adapt it to the terrain over which it is rolling.

• **Suspension** of the tires in fore-and-aft pairs is such that the forward tire bags can be tilted upward to act as compactors to pack down snow, sand or mud, if necessary.

• **Wide tread** allows the heavy vehicles each weighs 15,000 lb. to negotiate almost any type of terrain such as boulder-strewn areas, rough hills, tundra, snow, and swamps.

• **Low pressure** permits the truck-trailer to travel over such bumpy surfaces as railroad tracks at speeds up to 25 mph. while transmitting virtually no shock or vibration to missile or personnel because the soft rubber bags engulf rails and ties and the vehicles flow over the obstacles. On smooth terrain, the machine can travel up to 40 mph.

Teracruzer Details

All eight wheels of the Teracruzer are powered by a single, 250-hp. Continental air-cooled engine. The engine also supplies the power needed to operate the missile ground support equipment such as cranes and electricity.

The Teracruzer is a multi-purpose vehicle. Other than towing the Translauncher, it can, without altering its flat bed or trape, transport missile noses, boosters, fuel, crane, squadron cargo, communications and supply gear and provide the necessary testing power. This concept constitutes Goodyear Aircraft's basic missile ground support system for the TM-61B.

The cab-over-engine style vehicle weighs 15,000 lb., is 30 ft. long and 9 ft. wide. Its 18-ft. flatbed body has an 8-ton capacity.

The Translauncher, which also weighs 15,000 lb., is 34 ft. long—somewhat shorter than the Matador—and 9 ft. wide.

All equipment will operate in temperatures from −65F to +125F.

Both the Teracruzer and Translauncher are air transportable in a Lockheed C-130 Hercules.

TM-61B Matador

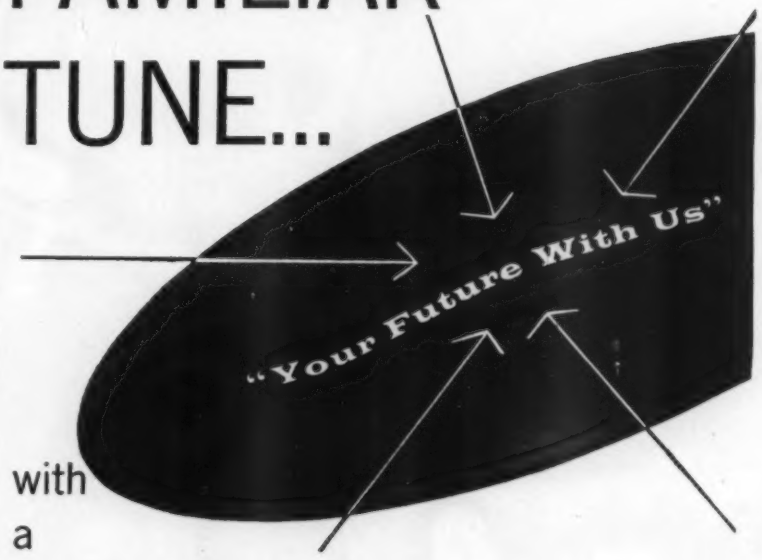
Martin's TM-61B Matador is longer than the original missile, has increased range and a more powerful engine. Its blunter nose houses an improved guidance system.

Folding wings allow the missile to be hauled over roads, yet it can be put into flying condition in minimum time.

The Matador's dimensions are: span—22.9 ft.; length—42.1 ft.; fuselage diameter—54 in.; gross weight—15,000 lb. It is powered by an Allison J-33 jet engine.

Production of the many components of the missile system has already begun under multi-million dollar Air Force contracts. All items of the missile ground-support system were developed

FAMILIAR TUNE...



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Getting acquainted, of course, is a give-and-take proposition. You can start the ball rolling with a resume to Mr. Richard Auten at our Bridgeport Personnel Department.

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THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it" — "they" being all the industry's front line of innovators and improvers—and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you — giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

McGRAW-HILL PUBLICATIONS

for the USAF's Air Research and Development Command, with technical guidance from Wright Air Development Center, for Tactical Air Command use with the Matador.

Predecessor Model

The TM-61 Matador, predecessor of the TM-61B, was transported and launched from a different type of trailer.

The transport vehicle was developed in 1951 through a cooperative effort by Martin engineers working with designers from Union Switch & Signal division of Westinghouse Air Brake Co.

The launcher, whose chassis was made by Fruehauf Trailer Company, was manufactured by U. S. & S.

The tandem axle trailer mounts all the electrical, hydraulic and mechanical controls necessary for launching the missile.

The TM-61 Matador has been on duty overseas since March 1954.

OFF THE LINE

Lockheed Aircraft Service and its parent company, Lockheed Aircraft Corp., were commended by Rear Adm. James S. Russell, Chief, Navy Bureau of Aeronautics, for "resolving difficult engineering, production and flight problems in modifying four P2V-7 Neptune patrol bombers and have contributed substantially to the support and success of Operation Deepfreeze II." This is the Navy's current expedition in Antarctica. The modifications involved: rigging the aircraft with both skis and conventional landing gear, installation of special heating equipment for pre-heating engines prior to take off, provisions for heating the aircrafts' interiors while being serviced on the ground, and installation of JATO bottles for additional thrust at take off.

Ten explosion-proof test stands for production testing fuel controls for Pratt & Whitney Aircraft's J57 and J75 jet engines will be manufactured for P&WA by Consolidated Diesel Electric Corp.'s Test Equipment division. The stands, equipped with 125 hp. variable speed drives, will handle fuel flows up to 30,000 lb./hr. and pressures to 1,000 psi. The stands are designed to accommodate the addition of automatic electronic control and recording equipment at a later date. Test consoles are isolated from drive motors by cinder block walls to protect the operators.

Mobile, ground support equipment, incorporating a gas turbine compressor, is being manufactured by Consolidated Diesel Electric Corp. for the Royal Canadian Air Force's supersonic CF-105 jet fighter. The company will supply the self-propelled pneumatic powerplants, used to start the CF-105, under an $86,000 contract. The gas turbine compressor is rated at 117 lb./min. at 50 psi. and 370F discharge temperature on a standard day.

A USAF contract for precision camera parts made from titanium has been

Detection Gear Locates Minerals

Sikorsky S-55 of Aero Service Corp. is fitted with devices on the nose, on the tail and under the tail boom to detect the presence of lead, copper and zinc deposits under ground. New magnetometer gear, developed by Geophysical Department of Newmont Mining Corporation of New York indicates the size or grade of the ore body. Other equipment is carried for locating radioactive ores. Aero service has flown more than 1 million mi. with airborne electromagnetic equipment for the mining industry. Helicopters can cover more ground in a day than ground crews can in months.

awarded to Gordon Enterprises, camera manufacturers. One part will be camera shutter blades .007 in. thick, about the same thickness as photographic film. The titanium shutter blades, which combine high strength with extreme lightness, will allow camera shutter speeds heretofore unobtainable. The titanium blades are also corrosion-resistant.

An undisclosed number of twin-jet Douglas A3D carrier-based air craft are being converted to aerial tankers. Probe-and-drogue system will be used. Conversion kits will consist of a reel, hose, drogue and dump line. In addition, large extra fuel tanks will be installed in the planes' bomb bays. The tanker unit within the bomb bay will be self-sufficient except for the power source and remote controls. Also, all A3D aircraft will be converted as receivers by the addition of probes so that they may be refuelled in flight by tanker aircraft. The 600 mph-plus tanker A3Ds will be used to refuel Navy fighter, interceptor and bomber aircraft. Flight Refueling, Inc. of Baltimore, Md., has been awarded a $2-million contract for design and production of the hose reel installation.

WHAT'S NEW

Publications received:

Patent Notes for Engineers—by C. D. Tuska—Pub. by McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York 36, N. Y. $4.00; 192 pp.

This, the seventh edition, gives a clear idea of what patentable inventions are and how to protect them, with explanations of how applications are prepared, filed, and acted upon.

The Journal of Air Law and Commerce—Ed. by Edward C. Sweeney—Pub. quarterly by the Transportation Center at Northwestern University, 1818 Hinman Avenue, Evanston, Ill. Single copy, $1.75; subscription, $6.00.

The Journal covers the latest developments in domestic and international aviation, issues and trends, recent court cases, state and local aviation news, and includes a bibliography of pertinent books and periodicals.

Competition Among Domestic Air Carriers—Prepared by the Civil Aeronautics Board—Pub. by the Air Transport Association—May be ordered from Mr. Gilbert L. Bates, Research Department, Air Transport Association, 1107 Sixteenth Street, N.W., Washington 6, D. C. $90.00.

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3 **Experienced Aircraft Air Conditioning Engineer.** Work on weapons system advanced design aircraft. BSME or equivalent essential.

4 **Experienced Aircraft Engineer.** Work on environment control engineering or weapons system advanced design aircraft. BSME or equivalent essential.

5 **Experienced Aircraft Engineer.** Work on escape systems design on weapons system advanced design aircraft. BSME or BSAE degree or equivalent essential.

6 **Experienced Aircraft Engineer.** Cockpit arrangement and provision studies on weapons system advanced design aircraft. BSME or equivalent essential. Human Factors experience desirable.

CONTACT: Mr. Les Stevenson, Engineering Personnel, Dept. 562AW, North American Aviation, Inc., Los Angeles 45, California.

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The section on engines brings you data on types, compressors, compressor bleedings, combustion chambers, turbines, exhaust cones, fuel systems, lubrication, starting, fuels, dimensions, and many other factors.

New edition includes data on—

—Russia's TU-104, first flown this side the Iron Curtain in March, 1956

—the Lockheed Electra, Convair 880, Percy Delta 2, S.E. 210 Caravelle

—Guided missiles, research rockets, etc.

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CAB and conducted in March and September of 1955, provide for the first time quick and authoritative answers to many questions about competition in the nation's scheduled airline industry.

Flying Saucers: An Analysis of the Air Force Project Blue Book Special Report No. 14—by Dr. Leon Davidson—Pub. by Dr. Leon Davidson, 64 Prospect Street, White Plains, New York. $1.00; 83 pp.

As a public service, Dr. Davidson has presented a photo-offset copy of the full text of the Air Force report, some of the important tables and figures from that report, and his own analysis of it.

ASTM Methods for Chemical Analysis of Metals—Pub. by, and available from, the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa. $8.00; 640 pp.

This publication is essentially a part of the Book of ASTM Standards, and contains all ASTM methods for chemical analysis of ferrous and non-ferrous metals and alloys, including spectrochemical procedures.

Reports Available:

Atmospheric Models—Pub. by, and available from, at no charge, General Electric Company, Missile and Ordnance Systems Department, 3198 Chestnut Street, Philadelphia. 28 pp.

Guided Missiles: Modern Weapons for the Modern Army—Pub. by, and available from, at no charge, General Electric Company, Missile and Ordnance Systems Department, 3198 Chestnut Street, Philadelphia, Pa. 16 pp.

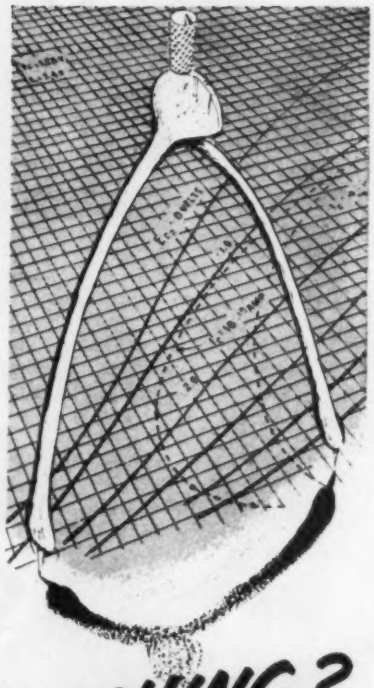
The brochure includes a 45 r.p.m. recording of the launching of the Army Bumper missile.

The following reports are available from the Office of Technical Services, U.S. Department of Commerce, Washington 25, D. C.:

Preliminary Measurements of Non-steady Velocities in a Single Stage Axial-Flow Compressor—by H. Yeh, H. M. Croner, and D. E. Andrews, the Johns Hopkins University for Wright Air Development Center. Order PB 121434. $1.25; 48 pp.

A Design Manual for Regenerative Heat Exchangers of the Rotary Type—by H. H. Sogin and K. Hassan, Illinois Institute of Technology for Wright Air Development Center. Order PB 121469. $3.25; 122 pp.

Study, Standardization of Specifications for Insulated Wire—by M. A. Horn and R. W. Stoneburner, Jr., Corvey Engi-



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A Quick Disconnect Adapter for External Power Cable—by J. W. Hamilton, Airtron, Inc. for Wright Air Development Center. Order PB 121283. $.75; 26 pp.

Study of Coiled Tubing for Aircraft Hydraulic Systems—by C. H. Cooke and R. D. Stouffer, The Glenn L. Martin Co. for Wright Air Development Center, Feb. 1955—Available from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.; order PB 121477. $3.00; 115pp.

Properties of Molybdenum Disulfide—Designated Bulletin Cdb-5 in the Climax Chemical Data Series—Issued by Climax Molybdenum Co., Dept. L, 500 Fifth Avenue, New York 36, N. Y., and available on request. 2pp.

Regulations of the Administrator, Part 507, Airworthiness Directives—A Civil Aeronautics Administration publication available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Subscription price, $1.50 domestic; $.50 additional if mailed to a foreign address.

Engineering and Design Manual—To be published by the Investment Casting Institute in the late Spring of 1957; may be ordered in advance from the Institute, 27 East Monroe Street, Chicago 3, Ill. $5.00; 64pp.

Sud-Est to Produce 500 Alouette Copters

Paris—Sud-Est Aviation has set a production and sales goal of 500 for its turbine-powered S. E. 3130 Alouette II helicopter, holder of the rotary-wing world's altitude record of 26,932 ft. Mass production of the multi-purpose helicopter is under way in Sud-Est's Courneuve plant near Paris.

Alouette II now is rolling off the assembly line at the rate of 13 a month. At the end of 1956, 32 production models of the five-place copter had been delivered to the government.

Bristol Awarded Overhaul Contract

Winnipeg—Bristol Aircraft (Western) Limited of Winnipeg has been awarded a $1,220,000 defense contract for the repair and overhaul of Royal Canadian Air Force aircraft during the two years ending March 31, 1958.

The Bristol plant in Winnipeg is one of the largest in Canada, and it has been doing extensive work for defense.

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Dept. A, Sensenich Corp., Lancaster, Pa.
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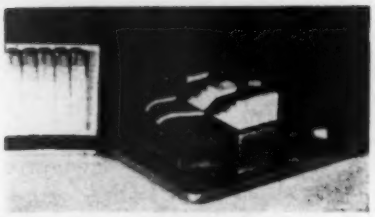


Baggage Fire Detector

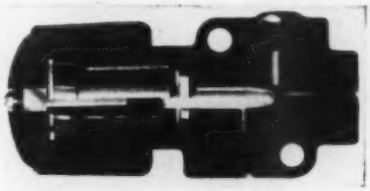
Baggage compartment fire detector is thin shelled, stainless steel, hermetically sealed unit weighing 4.3 oz. It has temperature adjustment range from 50F to 350F, can withstand exposure to −65F indefinitely and to 2,000F for short periods. Detector is two-wire unit with separate terminal block and is mounted on slotted cover plate which fits existing electrical boxes. Contacts close when temperature rises above set-point. Current rating is 5 amp. at 125 VAC, 2 amp. at 28 VDC and 1 amp. at 48 VDC. It is being installed in Class D baggage compartments of new DC-6 and DC-7 aircraft.

Aviation Products Division, Fenwal Inc., Ashland, Mass.

Borescope Examines Interiors

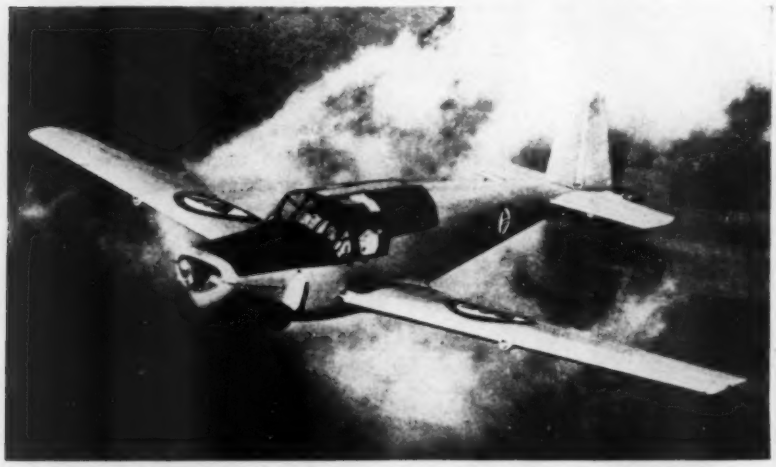
Periscope can be inserted through 1/10 in. openings to view objects 20 feet away. Called "borescope," it is a modification of medical instruments used to examine the interiors of body cavities. A built-in flashlight illuminates the object. Borescope may be inserted in spark plug hole to check cylinders and valve seats for cracks or used to read gages in nuclear reactors from a safe distance. Time is saved in these and many other uses where disassembly can be avoided. Lens system, called "Fontar," has objective lens at one end, achromatic intermediate lenses throughout length of .09 in. tube and ocular lens and erecting prism at viewer's end.

National Electric Instument Co., 92-91 Corona Ave., Elmhurst, L. I., N. Y.



Valve for Corrosion Service

Corrosion-resistant, bubble-tight needle valve is compatible with standard fittings and piping methods. May be useful in handling oxidizer and propellant in liquid propellant rocket systems. Non-toxic and non-burning valves are



Light Trainer for Norway's Air Force

Swedish-designed Saab-91 Safir is used by the Royal Norwegian Air Force as a light trainer in primary schools. Powered by a 190-hp. Lycoming, the Safir has a top speed of approximately 170 mph., cruises at 150, and has a range of 670 mi. Maximum gross weight is 2,686 lb. The trainer can be fitted with two 8-mm. machine guns in the wings and eight 63-mm. rockets or training bombs. It has a retractable tricycle landing gear. Civilian versions have also been built in Sweden and under license in Holland. Used as a personal and business plane the Safir seats three or four persons; by removing the rear seats a quarter-ton of cargo can be carried. Several foreign airlines have purchased Safirs for use in their pilot training programs.

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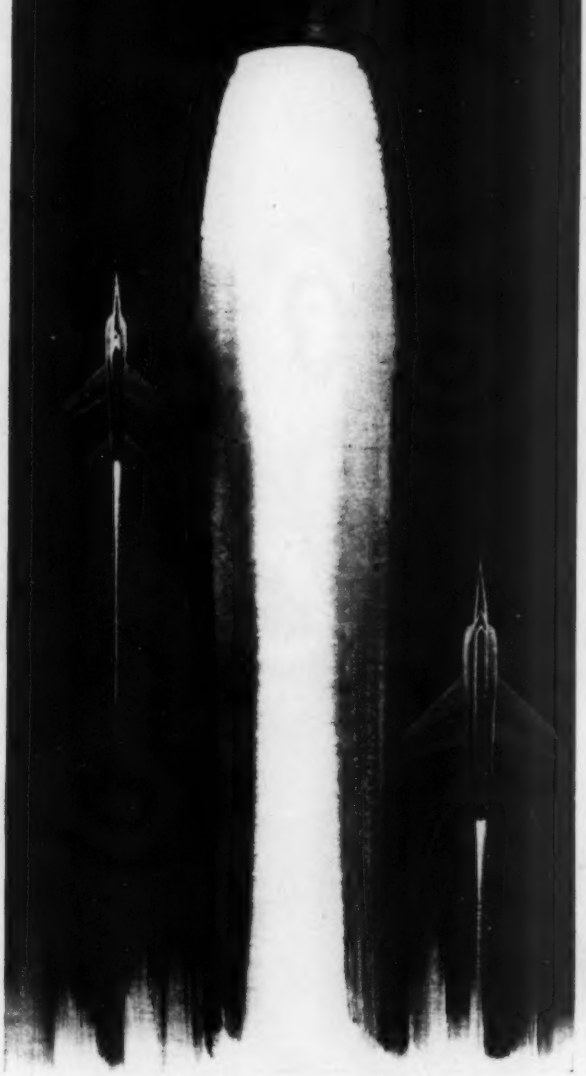

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The successful development of aircraft and missiles to guard America's security demands the highest order of creative thinking plus a finely-tuned sense of responsibility. A unique blending of these essential qualities with the will and facilities for accomplishment enables Propulsion Research Corporation to solve propulsion problems created by fantastic speeds and altitudes.

Whether developing advanced propulsion systems or the smallest possible axial blower, PRC engineers and scientists work in teams in an intellectually stimulating environment. Projects receive the benefit of impressive resources in research, analysis, design, prototype fabrication and test, and manufacture.

Current programs include engineering, research and development in the turbo machinery and related fields, and development and production of aircraft accessories. Underway are projects in specialized centrifugal and axial flow blower fans, turbo pumps, turbines, fluid pumps, valves, auxiliary power units and cabin conditioning units.

In solving critical technical problems of precision components for aircraft and missiles, PRC is pacing America's progress in the air . . . and into space!

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made of polyvinyl chloride, Teflon vel-F and 18-8 stainless steel. They provide micrometer type adjustment by coupling calibrated body and indicator handle to fine threads that position the needle. All contact with the liquids handled is limited to corrosion resistant materials.

The valve operates in temperatures up to 170F and pressures up to 170 psi.

Chemtrol Corporation, 1513 W. El Segundo Blvd., Compton, Calif.

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Ear protector for ground crewman endangered by jet engine noise combines fluid-filled sealing pads and simple self-adjustment to provide maximum noise protection and nearly universal

fit. It uses no bulky absorbing material nor large sealing shells. Weight is less than 10 oz.

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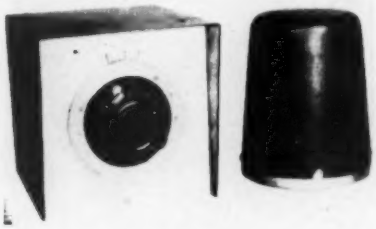
Radio Corporation of America, RCA Building, 30 Rockefeller Plaza, New York 20, N. Y.

High Accuracy Remote Control

Follow-up remote control of high accuracy and low costs sets position of valves, variable speed drives, jacks,



rheostats, etc. according to position of vernier dial on unit face. Accuracy with precision, multi-turn potentiometer is ±0.04%. Adjustable anticipation slows control motor as desired setting is ap-

Shown seated above is K. W. Goebel, Rohr Design Engineering Manager

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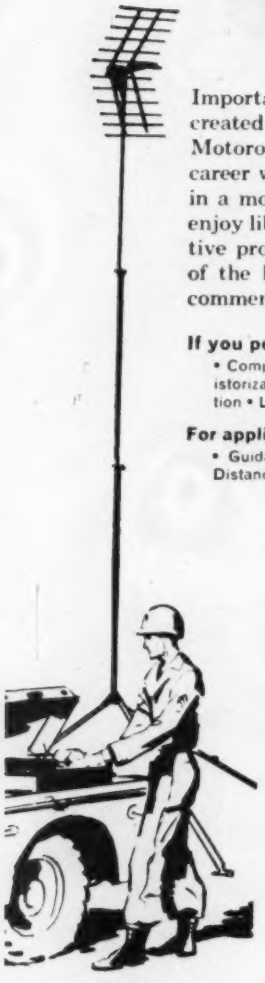

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Mr. V. Sorenson, Dept. G
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RIVERSIDE, CALIF.
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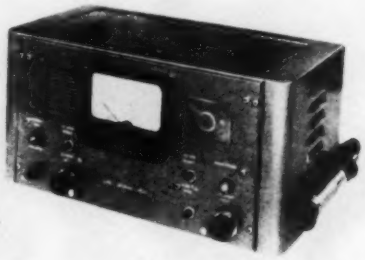
proached, thus eliminating overshoot and hunting. Accuracy adjustments permits introduction of lost motion which may be desirable for certain applications. Unit is designed for use with shaft mounted control gear motor with built-in potentiometer made by same manufacturer but may be used with other gear motors. Follow-up time may be a minute or less than a second depending on control motor used.

Jordan Co., Inc., 3235 W. Hampton Ave., Milwaukee 9, Wis.

Area Radioactivity Monitor

Radioactivity monitor for checking areas, personnel and equipment. Called Nucliguard, the unit has new 3-cycle logarithmetic count rate meter. It is available with either beta-gamma sensitive GM probe or gamma sensitive scintillation probe. Any desired warning level may be preset. When it is



exceeded, a visual and audible alarm warns people in the area. It plugs into any 110 v. outlet and is only 8 in. x 9 in. x 18 in. Weight is about 15 lb. Probe has 6 ft. reach. Equipment has built-in precalibrated test sample and 5,600 cpm. test signal. Sensitivity is 50 to 50,000 counts per minute.

Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis 18, Ind.

Turco Develops New Magnesium Finishing

Los Angeles—Development of two magnesium finishing processes to replace Dow No. 17 and Dow No. 18 has been announced by Turco Products, Inc., manufacturer of industrial chemical processing compounds.

The company says the single-package Turco processes are designed to provide magnesium with better corrosion resistance, abrasion resistance and paint bonding properties, to eliminate the need for precise measuring and mixing of several chemicals and to overcome the resultant inconvenience and chance for error. Additionally, it said, they do not require complicated control procedures.

Both processes are approved for use by the Magnesium Division, Dow Chemical Company.

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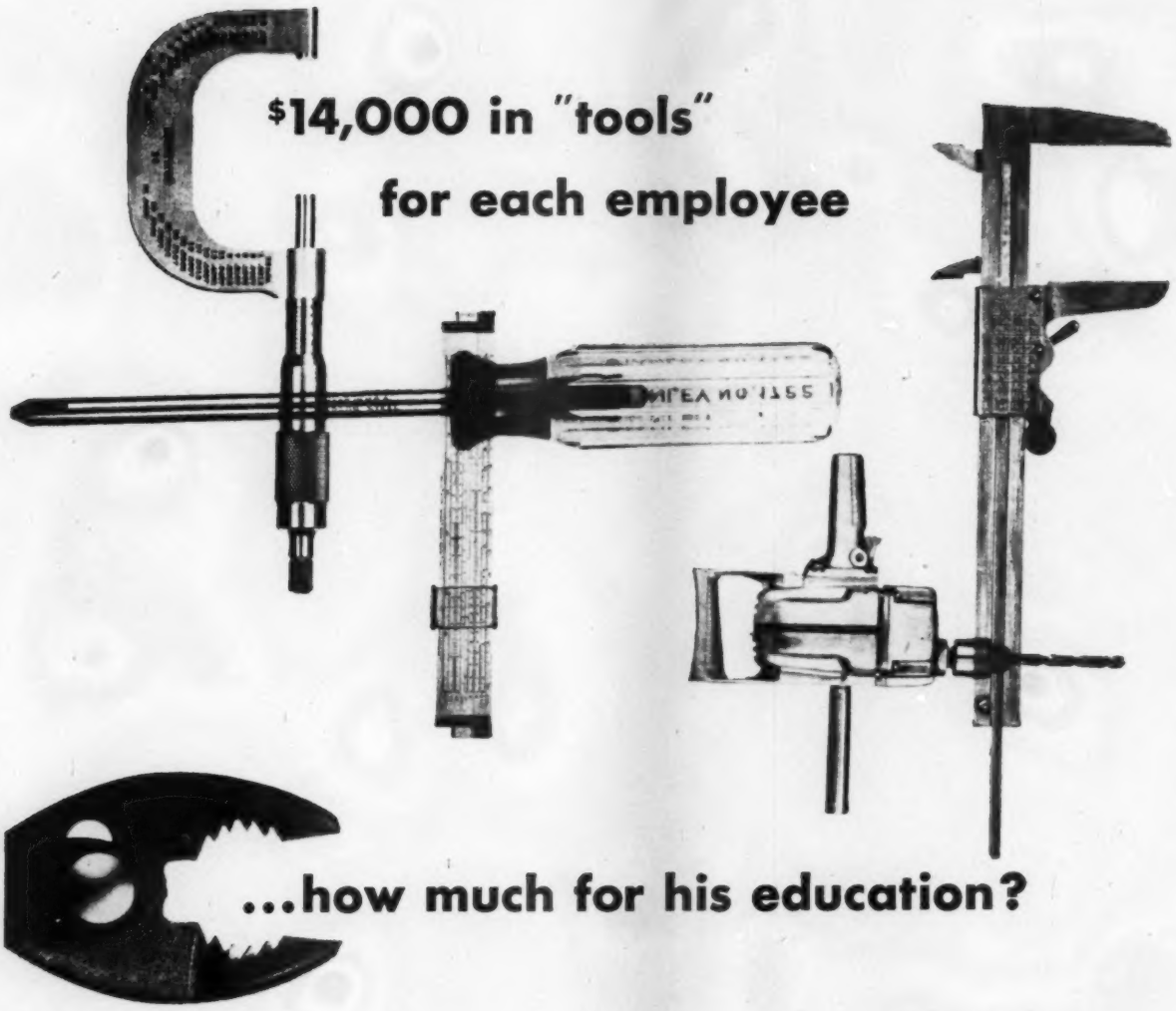

Today, business invests an average of $14,000 in each employee's job. The question for businessmen is: Are we training enough people who can hold down these jobs? Schools are the answer. And it's simple self interest to help community groups get the teachers and equipment schools need. Shortage right now: 200,000 classrooms, 165,000 teachers!

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Scientists on Verge Of Tiny Measurement

Washington—Government and industrial measurement scientists are approaching the verge of working the "smallest miracle" of precision measurement—splitting the inch into fractions of millionths.

Louis Polk, president of the Sheffield Corporation, Dayton, Ohio, and vice president of Bendix Aviation Corporation, told the 12th annual meeting of the Dimensional Standards and Metrology Division of the American Ordnance Association at the National Bureau of Standards that:

"Some industries producing precision products for both military and civilian use have increasing need for the super-accurate gaging and measuring devices that can be produced and utilized, by refining our absolute standard measurement to the seventh decimal place—or one tenth of a millionth of an inch."

The Sheffield executive, vice president of the American Ordnance Association and Chairman of its Dimensional Standards and Metrology Division, emphasized that the joint U. S. government-industry research program "has been the most practical and efficient method of advancing toward this most important precision measurement goal—an absolute standard of achieving gage block precision to one ten-millionth of an inch."

In order to enable industry to produce accurately on some requirements, to tolerances of a few millionths of an inch, gage blocks used to "set" gaging and measuring instruments in the supporting standards structure should be certified to accuracies within one-tenth of a millionth of an inch.

Mr. Polk congratulated Dr. A. V. Astin, director of the bureau, on progress toward this high degree of absolute gage block certifying accuracy being developed by the U. S. Bureau of Standards in a continuing joint research project with leading U. S. manufacturers of high precision gaging, control and measurement devices.

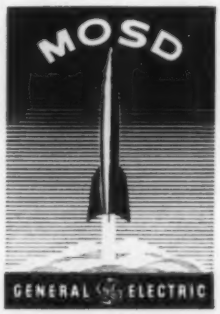
Putting this new "small miracle" of measurement to work will unfold new precision frontiers for U. S. production industries, Polk said.

U. of Colorado First In Astro-Geophysics

Denver—University of Colorado will start in late January teaching the first courses in a new department of astro-geophysics. Dr. Dayton D. McKean, dean of the university graduate school, said the department was the first of its kind in the United States.

McKean said the department will do

ENGINEERS & SCIENTISTS



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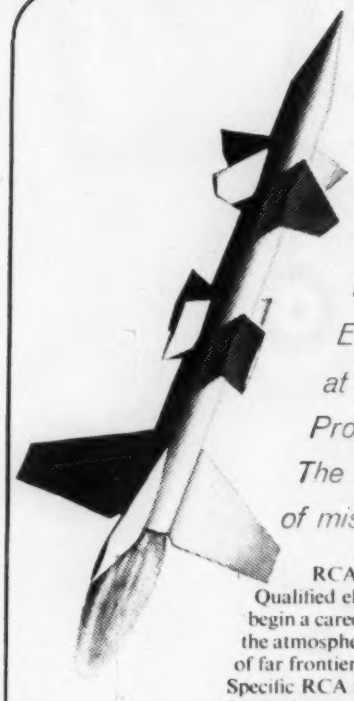

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–among other things–research on the effect the sun and other bodies in outer space will have on future space travel.

"Effects of the sun and other materials in outer space will have a bearing on rocket, satellite and space travel," McKean said.

Walter O. Roberts, director of the high altitude observatory at the University, said it will be taking the lead in the research of physical conditions of interplanetary space, particularly near the sun.

Graduates of the department will be fitted for work in aviation research and guided missile study.

"The department will start out in a small way," Roberts said. "Only a couple of courses will be taught in the department for the first few years with perhaps a dozen or so students working for graduate degrees in this field."

"Students other than those majoring in astro-geophysics will be able to take a course in the department," Roberts added.

The first course will be called "The Sun." Roberts said the department would use facilities already available in the high altitude observatory and in several laboratories on the university's campus.

Roberts said another field of study will be to determine "the effect of the sun's emissions on radio communications, the northern lights, the earth's magnetism and long-term climatic changes."

Roberts described the study of astro-geophysics as somewhat like astronomy, except that astro-geophysics deals with the relationship between astronomic bodies and the earth while astronomy is the study of celestial bodies.

Founding of the department followed close on the announcement that the University of Colorado had been designated a world data center for the International Geophysical year, 1957-58.

Solar Will Produce J75 Jet Components

Solar Aircraft Co. has received an Air Force contract for $1,300,000 of production facilities for J75 jet engine components.

Solar's Des Moines plant will build components for the engine in production quantities for Ford Motor Co.'s Aircraft Engine Div., which is manufacturing J75s under license from Pratt & Whitney Aircraft Co.

A 25% expansion of Solar's Des Moines plant is nearing completion to handle the J75 and various other aircraft engine and guided missile component programs.

Army Resumes Use Of Rick Helicopters

San Francisco—Rick Helicopters, Inc. was authorized to resume transportation of personnel in an Army shuttle service after the Army had suspended that phase of the operation as result of a fatal helicopter accident.

One of two Bell 47s assigned to the service crashed on Jan. 15, killing the pilot. Rick theorized it was caused by a seagull flying into the rotor.

The reinstatement came after an Army board made a special investigation of Rick's hiring practices, maintenance procedures, and equipment. Pending outcome of the investigation, the Army restricted the airlift to freight.

The shuttle service, now on a trial basis, links three army sites—Fort Baker, the Presidio, and Angel Island, where there is a Nike installation.

Hawker Aircraft Co. To Lay Off Workers

London—Seven hundred production and office workers at Hawker Aircraft Company's Langley, Buckinghamshire, factory will be laid off by summer.

The dismissals follow cancellation of a Ministry of Supply order for 100 Hunter fighters.

A company official said the workshops are to be retained at Langley for the time being. He added that some employes at a Hawker factory outside the main workshop are expected to hold onto their jobs.

According to a union spokesman, workers will be dismissed according to an agreed-on priority system.

Meanwhile, the Gloster Aircraft Company says it will drop 700 employes by June this year instead of 1,300 as originally estimated.

Convair Orders Tools For 880 Transport

San Diego—Convair is placing orders for $1,220,000 worth of machine tools for manufacture of its Model 880 jet transport. Capital funds for another $2 million worth of heavy tools and other equipment for the 880 program will be obligated soon, Convair says.

Ryan Declares 10 Cents Per Share Dividend

A regular quarterly dividend of 10 cents per share on common capital stock was declared by the board of directors of the Ryan Aeronautical Company. The 10-cent cash dividend is payable March 8 to stockholders of record February 19.

Guarding the Skies

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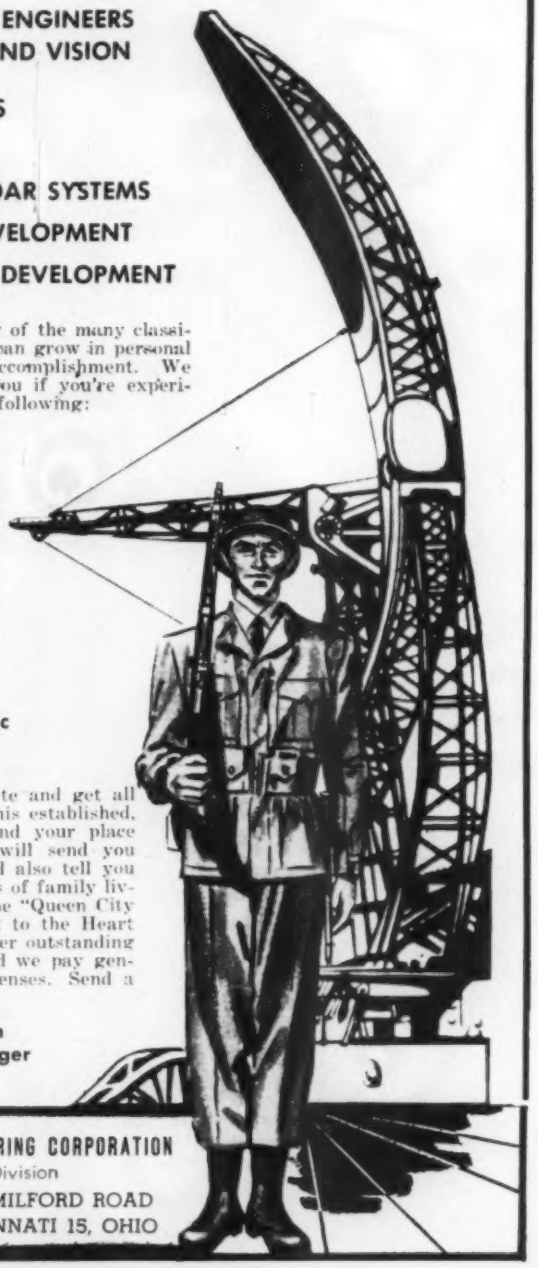

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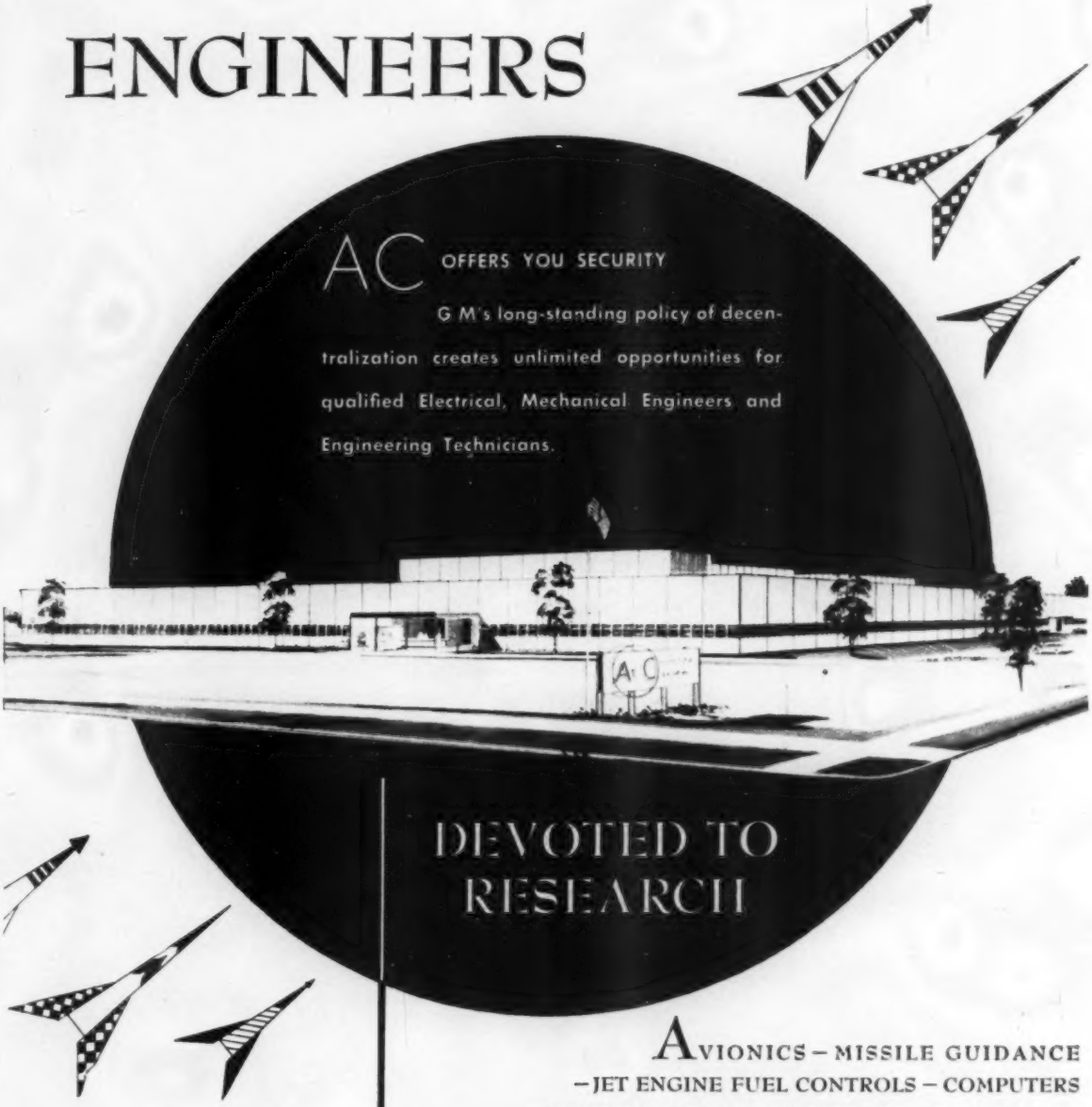

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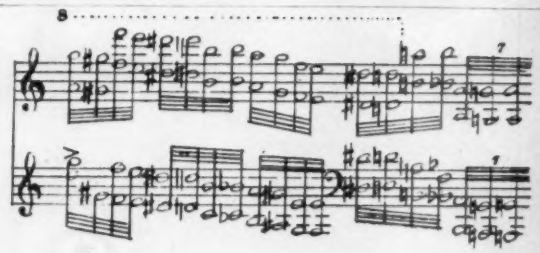
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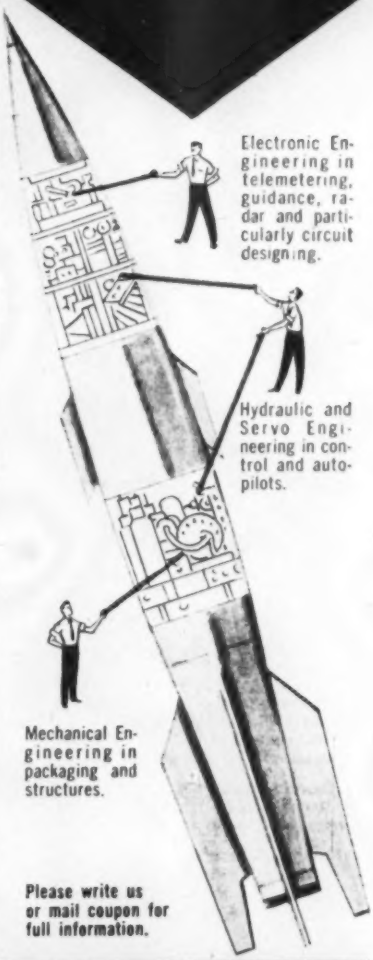

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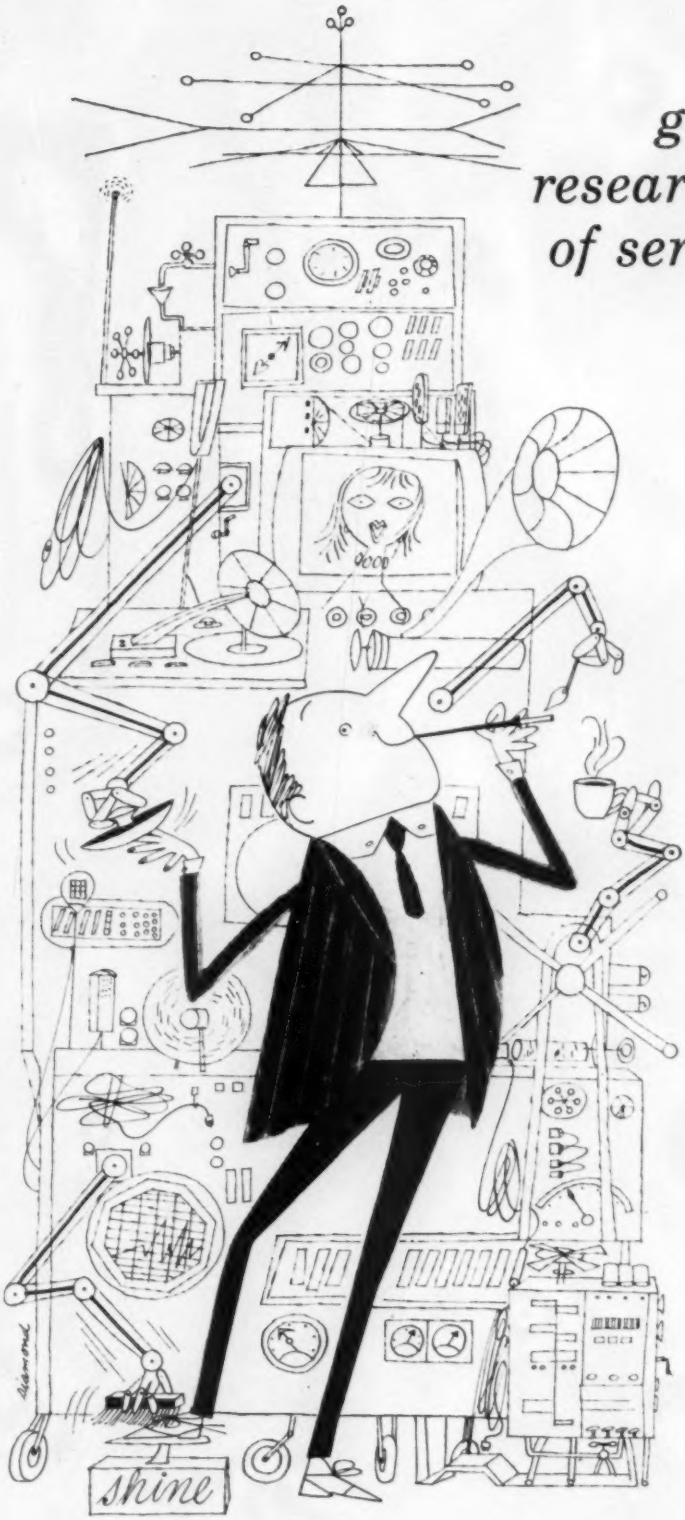

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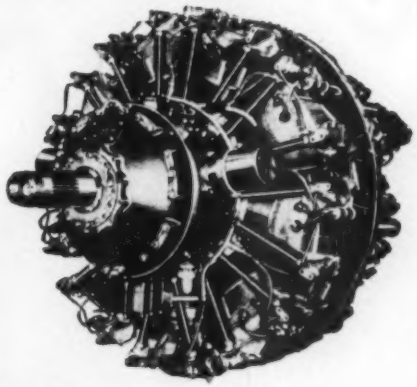

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LETTERS

Summing Up the Case

In recent years the ALPA embarked on a campaign to usurp the flight engineers' job. The campaign began mildly by means of manufactured rumor, passed by word of mouth from pilot to pilot. A classic example of this rumor, which has since been labeled "the big lie," was that the flight engineer was pushing for second in command and that the captain was losing his authority. We now find Captain R. C. Robson using this rumor in his editorial as if it were fact. I can best answer this by stating that we have yet to meet the captain who will testify that he is not in complete command of his cockpit.

The campaign of usurpation has now arrived at the point of all-out endeavor to discredit the flight engineer. In this respect, Capt. Robson used his editorial freedom to parrot the ALPA line even though he has very little personal knowledge of the true worth of the flight engineer. Certainly the record contains countless instances of that worth, while such incidents as the crash of a DC-6 on a training flight with three captains in the cockpit is evidence of what can happen without the flight engineer.

This is not intended to be a criticism of pilot ability. To quote from the November 1956 issue of the International Transport Workers Federation of which ALPA is a member, "Let it be clearly understood that non-pilot crew members fully realize the tremendous responsibilities of the pilot and consequently sincerely believe that in his own interests and in those of the traveling public he should have under his control a specialized crew to assist him in his already onerous tasks and to enable the aircraft to operate safely and efficiently. It is known that a great number of pilots are not themselves happy with this 'jack-of-all-trades' philosophy since, with all the good will in the world there comes a stage when human limitations are reached, and when heterogeneous duties may well end in disaster."

The advent of the jet does not in any way change the picture. In the operation of jet aircraft and accessory systems, all indications are that experience and training requirements must be high and can not be subject to coercive forces stemming from selfish desires. Mr. D. P. Davies, Chief Test Pilot of the Air Registration Board in Britain, was recently asked whether it would be preferable that the third man in the cockpit be pilot qualified. He replied that inasmuch as only two pilots can fly the aircraft at a time, there was no need of a third pilot, and the man should be there basically as a technical assistant to the pilot. In other words, each member of the operating crew must be expert in his duties and speak the same language and understand the relationship of his duty and job to the over-all question of safety in flight without harassment from outside organizations interested only in fomenting discord for their own selfish purposes. When all of the sly, distorted words and acts of the ALPA are sifted out, the plain fact stands out: the jet airliner, ever so much more than the piston engine aircraft, will require the services of expert, dedicated crew members, not the least important of which is the professional flight engineer.

DONALD H. TOWNSHEND
Huntington, L. I., N. Y.

The above letter by Flight Engineer Townshend is typical of a large volume of mail received by AVIATION WEEK *taking issue with Capt. R. C. Robson's column in the Dec. 24 issue. Capt. Robson has the editorial freedom normally accorded a columnist, and his views do not necessarily coincide with the editorial policy of this magazine which is expressed—clearly we hope—on the editorial page.—Ed.)*

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Danger in Vortices

I should like to comment on the much needed story that was done so well by Claude Witze in AVIATION WEEK (Dec. 17, p. 32), entitled "Jet Vortices Present Light Plane Hazard."

The danger to aircraft, particularly light aircraft, encountering turbulence created by the wake of a multi-engine propeller airplane, or any jet airplane, is ever-present and particularly dangerous because it is invisible.

The Civil Aeronautics Board issued a Safety Bulletin on this subject two years ago entitled "Keep Your Distance" (No. 187-53 currently available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. at 10 cents). It is even more important today because of the increased number of jet airplanes now flying.

In connection with the preparation of this CAB safety bulletin, I conducted a number of flight tests using an Ercoupe Model-G aircraft. As a precautionary measure, I was equipped with a seat-pack parachute and shoulder harness. All flights were conducted in conjunction with a Constellation aircraft at 3,000 ft. altitude and my controlled penetrations into the Constellation wake resulted as follows:

1. Right angle penetrations of wake one mile behind the Constellation; severe jolts and turbulence.

2. Right angle penetrations of wake one-half mile behind Constellation; Ercoupe's forward speed arrested abruptly, followed immediately by extreme turbulent instability.

3. Oblique 35° angle penetrations into the wake one-half mile behind the Constellation; a sudden, severe twisting force that inverted the Ercoupe almost instantly.

4. Identical heading penetrations dropping down into the wake one-half mile behind the Constellation, abrupt turbulent instability and partially inverted flight.

The severity of the result of all penetrations into the Constellation's wake increased when the Constellation was flying slowly, with gear and flaps down, a condition noted in Witze's article.

The Board's Safety Bulletin on this subject was circulated to the CAA air traffic controllers to alert them further to the danger of clearing light aircraft to land or take off too closely behind large, multi-engine airplanes. Articles such as Witze's, which emphasize the potential structural damage and loss of flight control that can result from inadvertent penetrations of wake or vortice forces, will help to eliminate accidents from this cause. Such information must be constantly and widely disseminated to all pilots of light aircraft.

EDWARD E. SLATTERY, JR.
Chief, Public Information
Civil Aeronautics Board

Pilot Simulation

In the Dec. 31 issue of AVIATION WEEK (p. 62-64), Mr. Klass has reported the results of some of our "Pilot Simulation Research."

Would it be possible to purchase reprints of this article?

I personally wish to commend Mr. Klass for his masterly reporting of this research.

Thank you, I remain

ANTHONY J. CACIOPPO
Head, Human Factors Aerophysics Dept.
Goodyear Aircraft Corp., Akron, Ohio

Professional Standing

I recently read a letter to the Editor of AVIATION WEEK, signed by Aircraft Engineer (AW Oct. 22, p. 154).

The situation with respect to professional engineering employment described in this letter is not limited to the aircraft field, but seems to be practically universal.

It is interesting to note that in the Western European countries, engineering is classed, from the salary and prestige standpoint, on the same level as the other learned professions. In Russia, this profession outranks any other. In the United States, the engineering "profession" is fortunate if it can hold its own with such quasi-professional groups as morticians, secretaries, nurses, and realtors. These at least can change locations and employers within their general occupational group; engineers very soon become chained within a very narrow specialty with one particular employer, or limited group of employers.

It is also interesting to note that although the United States still holds the lead in most types of industrial achievement (including aircraft), progress in other countries (particularly Russia) is recognized as advancing, in some fields, at a greater rate than ours. How much of this can be attributed to the place of engineers in the industrial and over-all picture?

HUGH L. LUGGI
Wilmington, Del.

heavy press extrusions

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New 8000 ton press now permits greatest design flexibility. Wide, integrally stiffened skin panels . . . solid, hollow, and stepped extrusions . . . extra large complex shapes . . . can now be obtained from Harvey in all aluminum alloys and in heat-treated lengths up to 80 feet.

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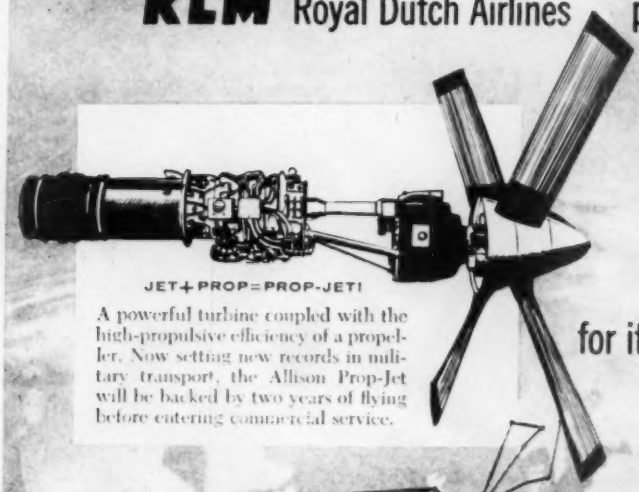

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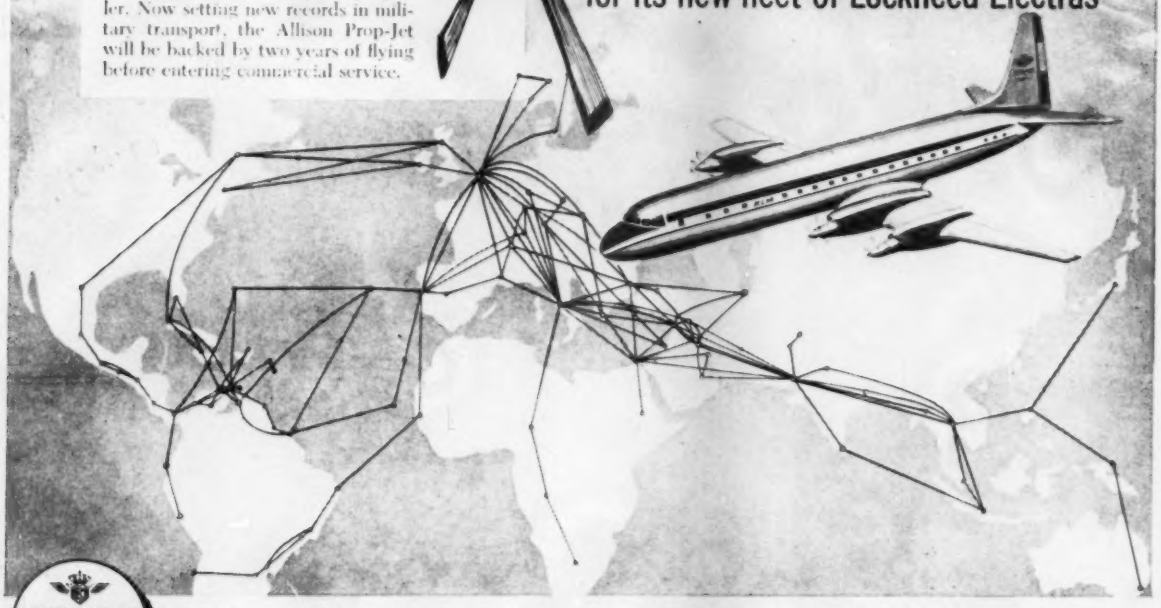

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KLM Royal Dutch Airlines, the world's first airline, steps into the jet age of world air travel by ordering a brand-new fleet of 7-mile-a-minute Lockheed ELECTRAS with Allison Prop-Jet power.

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